

**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 )

**COMMENTS OF SPRINT NEXTEL CORPORATION**

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**I. INTRODUCTION AND SUMMARY**

The incentive auction of broadcast television spectrum holds tremendous promise in repurposing critical spectrum to “unleash investment and innovation, benefit consumers, drive economic growth, and enhance our global competitiveness,” as discussed in the Federal Communications Commission’s (the Commission) Notice of Proposed Rulemaking (*Notice*).<sup>1</sup> Incentive auctions, though complex, present the Commission’s only opportunity to allocate new low-band spectrum critical for viable and competitive mobile broadband use. While the Middle Class Tax Relief and Job Creation Act (the Spectrum Act) contemplates auction of a number of other spectrum bands,<sup>2</sup> and the Commission has already signaled its interest in pursuing auction of at least one of these bands in 2013,<sup>3</sup> the 600 MHz Band represents a potentially pivotal allocation in the Commission’s spectrum management legacy of unleashing spectrum for competitive mobile use.

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<sup>1</sup> *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Notice of Proposed Rulemaking, 27 FCC Rcd 12357, 12358 ¶10 (2012) (*Notice*).

<sup>2</sup> Pub. L. No. 112-96, 126 Stat. 156, § 6401 (2012).

<sup>3</sup> *Service Rules for the Advanced Wireless Services H Block – Implementing Section 6401 of the Middle Class Tax Relief and Job Creation Act of 2012 Related to the 1915-1920 MHz and 1995-2000 MHz Bands*, Notice of Proposed Rulemaking, WT Docket No. 12-357, ¶ 1 (rel. Dec. 17, 2013) (proposing to assign H Block licenses through competitive bidding in 2013).

Sprint considers the Commission’s auction, service rules, and band plan for 600 MHz spectrum critically important to the future of the competitive wireless industry in the United States. The Commission should establish a goal of maximizing the amount of spectrum that can be auctioned for commercial use by multiple competitors, ensuring that whatever band plan and service rules are adopted provide the opportunity for as many wireless operators as possible to obtain useful spectrum. Focusing on this goal will not only result in increased revenues to fund the statutory objectives Congress identified in the Spectrum Act; it can ensure that competitors (and potential entrants) heretofore unable to assemble a competitive mix of high, medium, and, crucially, *low* band spectrum (*i.e.*, spectrum below 1 GHz) have a genuine opportunity to do so. For this reason, the Commission should also adopt relevant policies concerning low-band spectrum aggregation addressed in the context of its parallel proceeding on Mobile Spectrum Holdings<sup>4</sup> *before* completing its rulemaking on the incentive auctions. Alternatively, the Commission should at the very least adopt auction rules that address concentration of licenses *within* the 600 MHz Band, as contemplated in the Commission’s *Notice*.<sup>5</sup>

As Sprint described in the context of the Commission’s Mobile Spectrum Holdings proceeding, AT&T and Verizon have aggregated approximately 75% of the commercial spectrum below 1 GHz, including 86% of it in the top 10 U.S. markets and over 80% in the top 50 markets.<sup>6</sup> The Commission has recognized the critical importance of assembling a diverse mix of frequencies to an operator’s competitiveness.<sup>7</sup> Low-band spectrum occupies an

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<sup>4</sup> *Policies Regarding Mobile Spectrum Holdings*, Notice of Proposed Rulemaking, 27 FCC Rcd 11710 (2012) (*Spectrum Holdings NPRM*).

<sup>5</sup> *Id.* at ¶ 384 (proposing adoption of a rule permitting a single auction participant to acquire no more than one-third of all 600 MHz spectrum auctioned, consistent with section 309(j)(3)(B)’s direction to avoid excessive concentration of licenses)

<sup>6</sup> Figures calculated based on data in the Commission’s Universal Licensing System (ULS) as of November 28, 2012.

<sup>7</sup> *See, e.g., Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, Fifteenth Report, 26 FCC Rcd 9664, ¶ 307 (2011) (*Fifteenth Competition Report*) (“[G]iven the superior propagation characteristics of spectrum under 1 GHz, particularly for providing coverage in rural areas and for penetrating buildings, providers whose spectrum assets include a greater amount of spectrum below 1 GHz spectrum may possess certain competitive advantages for providing robust coverage when

especially impactful component of any operator’s spectrum portfolio – and resulting competitiveness. Its superior propagation characteristics enable an operator to deploy fewer cell sites to provide coverage (particularly useful in less-densely populated areas) and effective in-building penetration, allowing it to provide service at significantly lower capital and operating costs than using only mid-band or higher-band spectrum. Having multiple competitors with a meaningful quantity of low-band spectrum enables them to realize better operating economies and thereby compete more effectively, resulting in more innovation and more competitive pricing for consumers.

Though already possessing unrivalled spectrum depth below 1 GHz, AT&T and Verizon have nonetheless indicated a great interest in participating in the incentive auctions, likely aiming to acquire as much 600 MHz spectrum as possible at auction (as evinced by their early and steadfast opposition to any eligibility limits).<sup>8</sup> As part of its effort to make the most spectrum available to promote wireless competition, the Commission should implement a cap on spectrum holdings below 1 GHz as proposed by many commenters in its Spectrum Holdings proceeding, including potentially imposing a limit on the amount of spectrum any bidder can acquire in the incentive auctions – particularly for bidders already possessing undue concentration of low-band spectrum licenses.

Sprint also urges the Commission to consider the distinct advantages offered by a 600 MHz mobile allocation and band plan relying on Time-Division Duplexing (TDD), which would

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compared to licensees whose portfolio is exclusively or primarily comprised of higher frequency spectrum. As discussed above, holding a mix of frequency ranges may be optimal from the perspective of providing the greatest service quality at low cost.”); *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993*, Fourteenth Report, 25 FCC Rcd 11407, ¶ 283 (2010) (*Fourteenth Competition Report*).

<sup>8</sup> See, e.g., Letter from Kathleen Grillo, Senior Vice President, Verizon Wireless, to Marlene H. Dortch, Sec’y, FCC, MB Docket No. 12-268, PS Docket No. 10-255 (filed Oct. 24, 2012); Letter from Leora Hochstein, Executive Director, Federal Regulatory Affairs, Verizon, to Marlene H. Dortch, Sec’y, FCC GN Docket No. 12-268 (filed Nov. 30, 2012); Letter from Leora Hochstein, Executive Director, Federal Regulatory Affairs, Verizon, to Marlene H. Dortch, Sec’y, FCC, GN Docket No. 12-268 (filed Dec. 20, 2012); Letter from Joan Marsh, Vice President, AT&T, to Marlene H. Dortch, Sec’y, FCC, GN Docket No. 12-268 (filed Nov. 9, 2012); Letter from Joan Marsh, Vice President, AT&T, to Marlene H. Dortch, Sec’y, FCC, GN Docket No. 12-268 (filed Dec. 11, 2012).

maximize the amount of licensed spectrum available to all competitors. As described in greater detail below, a TDD band plan provides the Commission with a flexible, efficient, and highly modular way to reallocate the 600 MHz Band for mobile broadband use. The Commission’s proposed incentive auctions process depends heavily on flexibility and modularity, with a band plan capable of “accommodating varying amounts of available spectrum in different geographic areas rather than requiring that a uniform set of television channels be cleared nationwide.”<sup>9</sup> A TDD band plan can arguably best implement such flexibility and variability in the proposed reverse auction.

In contrast, a Frequency Division Duplexing (FDD) allocation and band plan requires separate frequencies for uplink and downlink transmissions, as well as a duplex gap between those transmissions, and would greatly increase the complexity of addressing significant interference concerns and technology limitations. Given the uncertain outcome of the proposed reverse auction, an FDD band plan is more complex, harder to assemble, requires more difficult and more extensive broadcaster repacking and likely limits the amount of spectrum available for auction to multiple competitors. In addition, an FDD band plan would likely substantially favor 700 MHz incumbents that already have low-band uplink spectrum that could be paired with asymmetric 600 MHz downlinks; operators such as T-Mobile and Sprint have no nearby 700 MHz spectrum to pair with unpaired 600 MHz channels that may come available in the repacking. TDD offers the Commission the ability to create a contiguous spectrum allocation, versatile to suit the variable amount of spectrum reclaimed in the reverse auction (and simplifying the intervening Commission repacking).

Sprint looks forward to engaging the Commission on these and a range of other pertinent topics in the Commission’s *Notice*. The Commission, through the adoption of its incentive auctions rules, has the potential to unleash a significant amount of critical low-band spectrum, promoting competition, expanding wireless broadband, and enabling innovative new products and services. Faced with a wide range of complicated technical and policy questions, the Commission’s approach should focus uncompromisingly on maximizing the amount of spectrum available for wireless competitors.

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<sup>9</sup> *Notice* at ¶ 124.

## II. AUCTION DESIGN PROCESS

Sprint applauds the Commission's diligent work in developing a framework for incentive auctions based on the authority granted in the Middle Class Tax Relief and Job Creation Act. With three separate, and yet highly interdependent components, the proposed incentive auctions framework contains a tremendous amount of detailed and thoughtful analysis by Commission staff. The Commission should adopt final auction and implementation rules that: 1) provide reasonable assurance to the prospective purchasers on the availability of spectrum within some predetermined timeframe, as well as information, to the greatest extent possible, on the licenses they are bidding for; and 2) provide reasonable processes, adequate information and predictable, fair compensation to television broadcasters that may be interested in participating in the auction or may be forced to move to another channel during repacking. Sprint looks forward to actively engaging with Commission staff to help ensure that this complex process works to the benefit of all stakeholders – and most importantly for the benefit of the American public.

### A. Proposed Auction Design

The success of the incentive auctions framework the Commission has proposed will depend in large part on ensuring that participation in the reverse and forward auctions is streamlined, accessible, and predictable. The Commission's proposal to engage broadcasters through webinars and other educational sessions holds significant promise in informing broadcasters about auction design, bid options, and the implications of participation (and non-participation) for their business plans.<sup>10</sup> Gaining the trust and support of broadcasters is a prerequisite to the ultimate success of the entire incentive auctions process. Similarly, the Commission's proposal to adopt mechanisms (such as a targeted relaxation of non-collusion rules) to facilitate channel sharing will help promote certainty and participation on the supply side of the incentive auctions.<sup>11</sup>

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<sup>10</sup> Notice at ¶ 36.

<sup>11</sup> *Id.* at ¶ 268 (Needless to say, any relaxation of anti-collusion rules should be carefully targeted to facilitating productive communications *between potential channel sharers*. Given the tremendous *ex ante* uncertainty of forward auction participants about the amount of spectrum and specific frequencies likely to be made available in each market, any information that reached

At the same time, the Commission should offer significant certainty for forward auction participants. Sprint submits that running the reverse and forward auctions concurrently would not be beneficial in providing forward auction bidder certainty – and could even diminish forward auction participation. Adequate certainty regarding the size and coverage of 600 MHz licenses is imperative, particularly for prospective bidders with a dearth of low-band spectrum. Similarly, additional bid options in the reverse auction, such as acceptance of additional interference from wireless broadband providers or reduction of service area, complicate the forward auctions process and could make it difficult for a forward auction participant to understand what it is bidding for. To the extent that the Commission ultimately adopts these additional bid options, doing so further counsels in favor of separating operation of the reverse and forward auctions. To the greatest extent possible, the Commission should provide potential forward auction bidders with timely and relevant information to ensure their informed participation. Relevant information includes the mix of licensees choosing to participate (and specifically, licensees choosing to relinquish their spectrum rights) as compared to the number likely to be repacked, because a larger percentage of licensees choosing to relinquish their spectrum rights in their entirety would presumably allow the spectrum to be made available more quickly, providing a higher level of assurance of timely availability for a forward-auction winner. By contrast, a market with extensive relocation and reconfiguration efforts may result in more delays in spectrum availability for a forward auction winner. This information has a *direct* and *substantial* effect on the price forward auction bidders will be willing to pay for 600 MHz spectrum – and also upon their likely participation.

## **B. Reverse Auction Operation and Broadcaster Repacking**

In order to gain adequate interest from forward auction participants, the Commission must ensure that its spectrum clearing efforts through the reverse auction and repacking result in a 600 MHz band plan that allows bidders to assemble licenses for nationwide coverage. As the

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forward auction participants could create dangerous and anti-competitive informational asymmetries among bidders).

Commission appropriately recognizes, clearing should begin at channel 51 and expand downward.<sup>12</sup>

The Commission should focus on clearing broadcast television stations from at least the entire 84 megahertz of spectrum running from television channel 38 through channel 51 on a nationwide basis. As described in greater detail *infra*, clearing of spectrum between channels 38 and 51 and the use of a TDD band plan for wireless broadband licenses, would result in significantly more competitive opportunities – and yield considerably greater flexibility – that could be tailored to the amount of spectrum made available in each market (if the Commission cannot clear the entire 84 megahertz everywhere). The adoption of a TDD band plan would also easily permit additional spectrum below channel 37 to be made available for forward auction where available. The Commission, through adoption of a TDD band plan, also could facilitate the addition of more licensed spectrum for mobile broadband use if, over time, additional broadcasters wish to relocate or relinquish their spectrum usage rights (made easier through a Commission modification of the Table of Allocations to include new allocations for fixed and mobile services throughout the entire range of UHF and VHF bands). However, Sprint supports the preservation of channel 37 for radio-astronomy and wireless medical telemetry service use.

### **C. Forward Auction Operation**

As previously alluded to, the Commission’s rules governing assignment of licenses in the forward auction will have a profound and lasting impact on wireless competition – and as a result, on the innovation and economic growth the Commission envisions the incentive auctions stimulating. In addition to promoting greater bidder certainty, the Commission should invoke its authority under section 309(j)(3)(B) to adopt eligibility criteria and bidding rules that prevent the last remaining low-band spectrum from being effectively divvied up between the two operators that already hold the vast majority of current low-band spectrum assignments.

Congress explicitly reaffirmed the Commission’s authority to adopt such rules in the passage of the Spectrum Act. Legislative provisions that would have weakened or eliminated the

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<sup>12</sup> *Id.* at ¶ 126.

Commission's discretion to adopt pro-competitive rules were not adopted,<sup>13</sup> despite intense lobbying efforts by AT&T and Verizon to strip the Commission of its authority to do so.<sup>14</sup> To the contrary, Congress expressed its clear intent that it had delegated to the Commission authority to "adopt and enforce rules of general applicability, including rules concerning spectrum aggregation that promote competition."<sup>15</sup> Indeed, the Commission may promulgate such rules in the context of a general rulemaking, or as in this proceeding, in the context of a specific auction rulemaking.<sup>16</sup>

If the Commission fails to adopt spectrum aggregation rules regarding concentration of low-band spectrum in the context of its Mobile Spectrum Holdings proceeding, it is critically important that the Commission adopt eligibility restrictions for the 600 MHz forward auction. Particularly in the event of an FDD allocation, in which less bi-directional spectrum is made available,<sup>17</sup> a lack of eligibility limits will almost certainly result in Verizon and AT&T acquiring virtually all of the bi-directional spectrum -- and potentially all supplemental downlink

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<sup>13</sup> See Letter from Senator Herb Kohl to Congressman Dave Camp and Senator Max Baucus (Feb. 9, 2012), *available at* <http://www.dslreports.com/r0/download/1726272~1341210bc62d9965ba401399f36c0a64/Kohl.pdf>.

<sup>14</sup> See Karl Bode, *Verizon, AT&T Lobby to Weaken FCC Spectrum Authority - Duopoly Protection Language Buried in Jobs Bill*, BROADBAND DSL REPORTS (Feb. 9, 2012), *available at* <http://www.dslreports.com/shownews/Verizon-ATT-Lobby-to-Weaken-FCC-Spectrum-Authority-118302>.

<sup>15</sup> Pub. L. No. 112-96, 126 Stat. 156, § 6404 (2012).

<sup>16</sup> See Speech of Hon. Henry A. Waxman, U.S. House of Representatives, 158 Cong. Rec. E265 (Feb. 28, 2012) ("... Congress intends for the FCC to continue to promote competition through its spectrum policies. The FCC can adopt and enforce, for example, a spectrum cap through a rule that applies either to all licenses or to spectrum offered in a particular auction, as long as such rules are not party-specific. [The 2012 Act] thus preserves the FCC's ability to require, among other things, the divestiture of specific spectrum, such as spectrum below 1 GHz, in order to promote competition.").

<sup>17</sup> By "bi-directional" Sprint means a spectrum allocation facilitating both uplink and downlink traffic. This could take the form of a paired FDD allocation, in which the uplink and downlink are separated by a duplex gap; likewise, this could take the form of a TDD allocation, in which uplink and downlink traffic are separated by time.

spectrum as a result of its depressed utility for other operators given the Twin Bells' aggregation of virtually all complementary spectrum for pairing in the 700 MHz Band.<sup>18</sup>

The Commission should adopt eligibility restrictions to prevent excessive concentration of low-band licenses (and in particular concentration of 600 MHz licenses). These rules might require tailoring based on the type of band plan (TDD, FDD, technology neutral, or a combination) and the specific amount of spectrum made available for mobile broadband. If, for instance, the Commission allocated seven channels for TDD use, eligibility rules might permit any bidder to acquire one 10 megahertz channel. Bidders exceeding the proposed low-band spectrum cap of one-third of available spectrum below 1 GHz, however, could be prohibited from acquiring more than the one 10 megahertz channel. Alternatively, for example, the Commission could limit any bidder from acquiring more than 40 megahertz of the available seven 10 megahertz TDD channels, or proportionately less if a smaller total amount of spectrum is harvested from the reverse auction.<sup>19</sup>

If, however, the Commission adopts an FDD band plan or a technology-neutral allocation, the Commission could prohibit any operator with more than one-third of the available spectrum below 1 GHz from acquiring more than one-sixth of the available 600 MHz spectrum (on a MHz\*POPs basis or otherwise).<sup>20</sup> Furthermore, to prevent a recurrence of what happened in the Lower 700 MHz Band auction, the Commission could prohibit any operator with more than one-third of the spectrum below 1 GHz from acquiring more than one 5x5 megahertz

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<sup>18</sup> As explained in greater detail below, the utility of supplemental downlink spectrum for increasing traffic asymmetry ratios (providing more downlink capacity) can only be truly realized when paired with spectrum with similar propagation characteristics. In other words, any supplemental downlink spectrum created by the Commission's repacking will only prove attractive to operators with paired 600 MHz licenses or 700 MHz licenses. Given the vast aggregation of 700 MHz spectrum by AT&T and Verizon – and their likelihood, absent stringent eligibility limits, to similarly aggregate 600 MHz licenses – the pool of potential bidders for any supplemental downlink spectrum is limited.

<sup>19</sup> This would, for example, permit an auction winner to aggregate the four 10 MHz TDD blocks into two 20 megahertz LTE carriers. Of course, a lower cap would be appropriate if less spectrum is available for auction.

<sup>20</sup> This would apply to both the bi-directional spectrum and any supplemental downlink spectrum.

license in the higher-frequency pairing if the amount of spectrum made available requires implementation of two frequency-pairing blocks.<sup>21</sup>

Regardless of the precise methodology, the Commission should ensure that effective auction rules are in place to guarantee that multiple operators have an ability to acquire low-band spectrum so that the economic and innovation opportunities inherent in using low-band spectrum can be fully realized. In that vein, the Commission should ensure that, if a winning bidder acquires more than one bi-directional spectrum block in a geographic area, or more than one supplemental downlink block in a geographic area, the blocks are assigned on adjacent frequencies whenever possible.

#### **D. Post-Auction Issues**

Sprint has a unique perspective regarding many of the challenges that will be faced in the repacking process: for the past five years we have worked with public safety entities, television broadcasters and other incumbents to relocate incumbent users from a substantial amount of the currently-available mobile broadband spectrum – an effort that has required replacing or upgrading millions of pieces of equipment, at a cost expected to exceed \$3.4 billion. Based on this experience, Sprint offers a number of suggestions for how the Commission should implement repacking, as discussed below.

As a threshold matter, Sprint encourages the Commission not to underestimate the importance of engaging with stakeholders at multiple levels to plan for and implement the important and difficult task of repacking broadcast television spectrum for mobile broadband use. Sprint's comments are based on the highly successful partnership effort among Sprint and the broadcast community to successfully complete the BAS retuning program mandated by the Commission's 800 MHz Reconfiguration Decision.<sup>22</sup> Carrying out that initiative provided

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<sup>21</sup> As discussed *infra* (notably in Figure 2), some FDD plans call for two separate duplexed pairings, one that has uplink on channels near television channel 51 and a second one that has its uplink and downlink bands on both sides of television channel 37.

<sup>22</sup> *Improving Public Safety Communications in the 800 MHz Band*, Report and Order, Fifth Report and Order, Fourth Memorandum Opinion and Order, and Order, 19 FCC Rcd 14969 (2004) (*800 MHz Reconfiguration Decision*).

valuable experience that can simplify repacking and facilitate cooperation among all stakeholders. For example, the Commission's 800 MHz Reconfiguration Decision did not provide guidance on possible taxation consequences of broadcasters replacing old, fully depreciated equipment with new equipment; resolving this issue required almost a year and delayed BAS retuning progress.<sup>23</sup> To the extent the Commission and all stakeholders can anticipate repacking issues – and deal with them transparently – all parties will better understand their rights and responsibilities and forward auction winners will have greater certainty as to the actual availability of 600 MHz channels.

### **1. Repacking and Relocation Costs**

Sprint believes it is important for all broadcasters to fully understand the funds that would be available for their repacking efforts, should they choose to sell, share, or not participate. Without that information, 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. The Commission should adopt clear rules and policies, before the reverse auction commences, so that television broadcasters can make the most educated decisions possible. Sprint recommends that the Commission take a number of important steps to ensure as seamless a repacking and relocation process as possible – steps that will ultimately improve certainty for participants in the reverse and forward auctions and as a consequence increase bidder confidence, participation, and, ultimately, revenues for the U.S. Treasury, including funding the nationwide public safety broadband network.

First, Sprint recommends that, as soon as practically possible (and in no event less than six months prior to the beginning of the reverse auction), 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. The Commission should engage third party experts to evaluate these inventories and provide the Commission with independent estimates on the cost of broadcaster relocation (including colocation through channel sharing), extrapolating these figures to estimate total relocation costs under a variety of scenarios and in different markets. As a result of this process, the Commission

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<sup>23</sup> See *BAS Relocation Status Report*, Sprint Nextel Corporation, WT Docket No. 02-55, at 17 (filed March 7, 2007).

should garner sufficient information to understand adequately the financial requirements necessary to accomplish repacking – information that would inform the Commission’s separate estimates on the appropriate number of auction bids to accept (and the appropriate prices for those bids).

While at first glance compilation of such an inventory might appear burdensome, a number of factors actually significantly simplify these efforts. For instance, as a result of the recent DTV transition, it is reasonable to assume that licensees have some level of system inventory already completed. Moreover, broadcasters will have likely begun to inventory their systems – and potential relocation costs associated with them – in their ongoing consideration of whether to participate in the auction. Based on work undertaken in the BAS relocations, Sprint estimates that third-party inventory audits would cost less than \$20 million, and could be accomplished expeditiously once an inventory was received – certainly prior to the auction if inventories were provided at least six months in advance.

## **2. Relocation Timeframes**

Just as the Commission should endeavor to provide broadcasters with the greatest possible information related to repacking and relocation, so too should the Commission bolster the confidence of forward auction bidders. Specifically, the Commission should provide reasonable assurances that spectrum licenses won by forward auction participants will be available within specific timeframes established prior to the auction process. Sprint considers the following three steps especially important in improving bidder confidence in the forward auction and thereby ensuring the maximum amount of revenue is generated through the auction.

First, the Commission should immediately undertake discussions with the major vendors necessary for successful broadcaster transitions (and multichannel video programming distributor (MVPD) reconfigurations) in order to fully understand their requirements, cost estimates, and estimated time lines to complete repacking in a market or on a national basis. The Commission should utilize this opportunity to understand the estimates and provide scrutiny of any assumptions that seem unreasonably long or short relevant to past transition initiatives. It is this information, in conjunction with the input from broadcasters on their expected levels of participation, that would best inform the Commission’s realistic expectations about spectrum

availability in each market and nationwide – and, conveyed to prospective forward auction participants, help improve bidder confidence and participation in the forward auction. A failure to obtain a comprehensive and realistic understanding of transition efforts will result in a lack of confidence on both the supply and demand sides, resulting in less participation and less revenue.

Second, forward auction winners must have reasonable assurances that spectrum they purchased will be available under specified timetables. To best accomplish this, the Commission should establish concrete milestones that must be met before broadcast licensees can receive full payment for either entirely relinquishing their spectrum rights or for reimbursement costs associated with the repacking. The Commission could adopt a variety of mechanisms to ensure timely relocation, including different methodologies depending on whether the payment is to a broadcaster completely relinquishing its spectrum rights, a broadcaster electing to channel-share, or a broadcaster being repacked. For instance, the Commission could adopt a structure similar to the following, depending on what the situation warrants: 50% of payments made to participants at the conclusion of the auction; 25% made upon the execution of contracts between suppliers and the broadcaster in cases in which a broadcaster is relocating or sharing (in which case these funds will come from auction revenues) or being repacked (in which case these funds will come from the TV Broadcaster Relocation Fund); and the final 25% disbursement upon the spectrum being made available for mobile broadband use.<sup>24</sup>

Third, to ensure timely relocation (and combat moral hazard associated with purposeful delays, with the expectation of operator or Commission funds to expedite delayed relocation), the final 25% disbursement should be subject to forfeiture if a licensee has not accomplished relocation within six months of the timeline adopted by the Commission for relocations absent extenuating circumstances. The Commission should consider suspension, modification or termination of a license in the event a broadcaster has unreasonably delayed relocation (subject, perhaps, to an expedited appeals process by the Commission). Having previously consulted broadcasters (including through developing inventories and estimates) and vendors, this result will not constitute an unreasonable penalty: indeed, the timeframe will have been informed by

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<sup>24</sup> To the extent that cleared spectrum remains encumbered by exogenous factors – such as potential for interference in adjacent spectrum not yet fully cleared – the cleared spectrum should nonetheless be considered ‘available’ and the broadcaster should receive the final disbursement.

the Commission's diligent efforts to understand the obstacles, costs, and timeframes associated with relocation.

### **3. Reimbursement Methodology**

The *Notice* solicits comment on the reimbursement methodology associated with the repacking, including on measures to prevent waste, fraud and abuse.<sup>25</sup> Sprint believes that any transition payment system should incorporate a cost-benefit approach, weighing the need for accountability and transparency of costs incurred against the cost (both in personnel, as well as lost time) of establishing systems and requirements to track every dollar spent. Specifically, Sprint recommends adoption of a broadcaster reimbursement system that balances efficiency and accountability. The point here is not to suggest potentially negative, misleading or uncooperative behavior by any stakeholder in the process; on the contrary, the proposals set forth below are intended to articulate the rights, responsibilities and procedures for every stakeholder to minimize surprises and uncertainties and maximize the likelihood of simplified, expeditious retunes.

As previously alluded to, Sprint believes that the Commission should require all broadcasters to provide inventories and cost estimates required for transition prior to conducting the reverse auction. These inventories would be audited by a third party to ensure their reasonableness. This estimate should form the basis for the Commission's subsequent reimbursement and payments should be made based on milestones achieved without further detailed invoices from broadcasters. The administrative efficiency of this system will not come at the cost of reimbursement inefficiency. In Sprint's experience with the BAS relocation, the amount Sprint paid the BAS licensees to relocate was within 5% of the initial cost estimates provided by the broadcasters. A reimbursement system based on payment of initial cost proposals would be fair and cost-effective for both the broadcasters as well as the U.S. Treasury. Indeed, if guaranteed a fixed reimbursement, broadcasters would likely be incentivized to look for ways to further reduce costs so as not to risk running over their cost allotment.

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<sup>25</sup> *Notice* at ¶ 334.

By contrast, a reimbursement system that provides reimbursement guarantees based on the submission of invoices, regardless of cost, has the potential to drive up relocation costs. Without prior estimates of likely costs and offered a promise of reimbursement, broadcasters have no incentive to look for cost savings, including more efficient ways of accomplishing the relocation. The TV Broadcaster Relocation Fund provides a *maximum* of \$1.75 billion for relocation; there is no alternative mechanism for funding change orders in a reasonable, fair and timely matter should the relocation efforts prematurely deplete the fund.

As part of its inquiry into reimbursement methods, the Commission also considers the merit of bulk purchasing opportunities or bulk service arrangements to reduce relocation costs.<sup>26</sup> Efforts to contain relocation costs are vital to cost-effectively maintain the TV Broadcaster Relocation Fund. Sprint does not believe, however, that there will be any substantial benefit from entering into bulk purchase agreements. While Sprint chose to enter into bulk purchase contracts for the BAS relocation, these efforts were necessary to provide assurance to equipment manufacturers that they would be reimbursed for the large quantities of raw materials that would need to be purchased to seed production lines. By contrast, these concerns do not seem to pertain to broadcaster relocation since vendors would have the full backing of government guarantees and the TV Broadcaster Relocation Fund to provide funding. In Sprint's experience, bulk purchasing also proved overly complicated: though Sprint did the initial contracting, licensees entered into a direct purchase order with the vendor, resulting in property tax, invoicing, and fixed asset record-keeping issues. Broadcasters likely have very efficient supply chain mechanisms in place and existing relationships with their major vendors. These preexisting relationships would likely enable broadcasters to procure the necessary equipment faster and at lower cost than a bulk purchasing contract could achieve.

The Commission also solicits comment on reimbursement of broadcaster equipment upgrades.<sup>27</sup> Provided that such upgrades do not result in additional funding or delays in transition, reimbursement seems entirely appropriate. However, the Commission should only make reimbursements available to licensees meeting a minimum system standard: a licensee who has intentionally chosen *not* to invest in efficient technology should not receive the windfall of a

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<sup>26</sup> Notice at ¶ 346.

<sup>27</sup> Notice at ¶ 343.

larger relocation reimbursement for the increased costs of transitioning from an antiquated system. To encourage efficiency, the Commission should set a minimum system standard from which it is assumed all broadcasters will be starting from, calculating transition costs from that point forward. As described previously, the work of inventorying current broadcaster equipment will provide the Commission with a wealth of information on the current state of equipment.

Beyond requiring inventories and audits, perhaps the most effective way to prevent waste, fraud, and abuse is to require that licensees return certain key components of their old equipment to a central repository. Equipment deposited in this central location would be verified and ensure that the licensee doesn't obtain an unintended windfall from the sale of equipment. The Commission could contract with a third-party warehouser to dispose of the equipment either through recycling or targeted sales opportunities.

Above all, the reimbursement program should adhere to a strict cost-benefit approach that weighs the need for assurance of costs incurred against the cost and time involved in providing such assurance. By way of comparison, Sprint's 1.9 GHz broadcast auxiliary service relocation program was managed entirely by Sprint with approximately 45 FTEs (excluding the use of outside consultants to manage the inventory audits and other system-design consulting services) and cost Sprint less than \$35 million. In contrast, the Commission's 800 MHz Reconfiguration Program requires the use of a third party Transition Administrator to oversee the 800 MHz reconfiguration process, at a cost of over \$170 million for the first four years of the program (a time period that will be relatively comparable to the overall incentive auction period). In addition to funding the Transition Administration itself, Sprint has incurred internal costs of approximately \$43 million to establish and maintain the 800 MHz Reconfiguration in accordance with TA-mandated guidelines. While the two programs are not fully comparable in scope and challenges, Sprint respectfully recommends that the Commission seriously consider avoiding all unnecessary administrative overhead. Not only will this potentially simplify and expedite repacking, but each dollar of unnecessary administrative overhead is ultimately a dollar not available to support construction and operation of the nationwide public safety broadband network.

### III. 600 MHZ BAND PLAN

The Commission faces “unique challenges” associated with creating a band plan from relinquished broadcast spectrum.<sup>28</sup> It must develop a band plan and associated technical rules that: 1) maximize the amount of spectrum that can be auctioned for commercial use by multiple competitors; 2) stimulate sufficient auction revenues to support the important public policy goals of the Spectrum Act; 3) provide reasonable protection from interference to services that will continue to operate in neighboring spectrum; 4) promote scale and interoperability, while avoiding the creation of band segments that are disadvantaged because of neighboring uses; 5) minimize the amount of spectrum that must be put to restricted use (such as guard bands and duplex gaps); and 6) provide a scalable approach that, if necessary, can work when the same amount of cleared spectrum is not available in all markets. Each of these challenges is significant, and together call for the Commission to pursue a bold and innovative solution.

The Commission proposes the adoption of a band plan based on FDD channel pairings, while also soliciting comment on whether it should designate 600 MHz spectrum for TDD use.<sup>29</sup> After extensive consideration of the various options, Sprint concludes that a TDD-only band plan is the best approach for meeting all the challenges associated with the 600 MHz Band. We discuss our rationale for such a recommendation below.

#### A. TDD Advantages

The Commission has assumed, for band planning purposes, that “the most likely technologies that will operate on this spectrum are 3G and 4G Frequency Division Duplex (FDD) technologies.”<sup>30</sup> Certainly, some parties will advocate for an FDD approach to the band plan, if for no other reason than that they are most familiar with FDD. However, the Commission should think “outside the box” in striving to find the best solution for meeting the numerous challenges described above as well as the unique circumstances of an incentive auction where the amount of spectrum available may vary significantly across geography. Sprint

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<sup>28</sup> *Notice* at ¶¶ 123.

<sup>29</sup> *Id.* at ¶¶ 183-184.

<sup>30</sup> *Id.* at ¶ 127.

believes that a TDD-only band plan would simplify the Commission’s deliberations and best enable it to meet these challenges.

Spectrum management agencies (and operators) worldwide have adopted TDD technology precisely because of its amenability for complex (and constrained) spectrum allocations – TDD has been called the “global solution for unpaired spectrum.”<sup>31</sup> Where spectrum is scarce, artificially bifurcating a band into dedicated uplink and downlink channels, with intervening duplex gaps, makes little spectrum policy sense.<sup>32</sup> The spectrum efficiency and deployment viability of TDD is indisputable.

TDD is widely used in the United States and throughout the world, and many new deployments are leveraging the inherent advantages of TDD. Indeed, significantly more bi-directional traffic is transmitted worldwide via TDD than via paired spectrum allocations.<sup>33</sup> For example, Wi-Fi, which is used throughout this country and around the world to provide data connections to the Internet and beyond, is a TDD technology. And major 4G standards, such as LTE and WiMAX, also include TDD implementations.<sup>34</sup> This should not be surprising. Regulators and operators initially adopted paired spectrum approaches decades ago, when FDD

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<sup>31</sup> Qualcomm, *LTE TDD, The Global Solution for Unpaired Spectrum*, at 7 (Sept. 2011), available at <http://www.qualcomm.com/media/documents/files/lte-tdd-the-global-solution-for-unpaired-spectrum.pdf>.

<sup>32</sup> See, e.g., Berge Ayvazian, *LTE TDD Operator Business Case & Adoption Forecast*, Heavy Reading at 27 (March 2011) (Noting that global interest in TDD technology is growing as a result of spectrum scarcity); *Broadband battle: TDD LTE vs FDD LTE*, THE TIMES OF INDIA (Apr. 5, 2012), available at [http://articles.timesofindia.indiatimes.com/2012-04-05/infrastructure/31293951\\_1\\_fdd-lte-frequency-long-term-evolution](http://articles.timesofindia.indiatimes.com/2012-04-05/infrastructure/31293951_1_fdd-lte-frequency-long-term-evolution) (“If frequency is a scarce commodity, as it is in India, then the cellular operators may not have the luxury of a large frequency band available that can then be carved out into dedicated sending and receiving channels. In that case, then time is used as the separator between sending and reception of signal [through TDD technology].”)

<sup>33</sup> Cisco Systems, *Cisco Service Provider Wi-Fi: A Platform for Business Innovation and Revenue Generation*, available at [http://www.cisco.com/en/US/solutions/collateral/ns341/ns524/ns673/solution\\_overview\\_c22-642482.html](http://www.cisco.com/en/US/solutions/collateral/ns341/ns524/ns673/solution_overview_c22-642482.html) (citing Cisco VNI Global Forecast, 2011-2016 study).

<sup>34</sup> For example, the Third Generation Partnership Project (“3GPP”) has developed TDD LTE standards that cover twelve bands. See 3GPP TS 36.101 V11.2.0 (2012-09).

was the simplest approach for meeting the needs of circuit switched voice services where customers expected to be able to talk and listen at the same time. Today, however, broadband providers worldwide are focused on deploying data services using communications protocols that don't necessarily transmit and receive at the same time, and don't require separate uplink and downlink transmission paths. As a result, many experts have suggested that TDD is a preferred approach when regulators are establishing new wireless bands that aren't extensions of existing bands.<sup>35</sup> And many broadband operators have deployed TDD solutions around the world.<sup>36</sup>

TDD also provides the ability to tailor the use of the communications channel to actual traffic that is being transmitted. There is broad unanimity among traffic projections that downlink traffic significantly exceeds uplink traffic.<sup>37</sup> Standards developers of 4G TDD

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<sup>35</sup> See, e.g., Hossein Eslambolchi, PhD, *LTE TDD versus FDD Debate*, 2020 Venture Partners Blog (Dec. 28, 2011), available at <http://www.2020vp.com/hossein-blog/2011/12/lte-tdd-versus-fdd-debate/> (discussing how LTE-FDD adoption is a function of legacy regulatory and deployment choices rooted in voice services; greenfield networks and allocations, by contrast, “will naturally gravitate to TDD-LTE.”).

<sup>36</sup> Operators already deploying TDD technology include: AERO2 (Poland), Bharti Airtel (India), Clearwire (United States) Hi3G (Denmark and Sweden), Mobily (Saudi Arabia), NBN (Australia), SoftBank (Japan), Sky TV (Brazil), and STC (Saudi Arabia). More than twenty-six operators, in Africa, Australia, North America, South America, Asia and Europe, have clear TD-LTE commercial deployment plans. See GTI Secretariat (ed.), *TD-LTE Industry Briefing*, Global TD-LTE Initiative (Aug. 1, 2012), available at <http://www.lte-tdd.org/sites/default/files/TD-LTE%20Industry%20Briefing%20-%20August%202012.pdf>.

<sup>37</sup> See, e.g., Stephen A. Wilkus, Distinguished Member of Technical Staff, Alcatel-Lucent, “TDD and Asymmetrical FDD,” at 2, FCC Forum on the Future of Wireless Band Plans, July 16, 2012, available at <http://transition.fcc.gov/bureaus/oet/tac/tacdocs/meeting71612/PANEL2.2-Wilkus-Alcatel-Lucent.pdf> (describing how aggregate traffic is typically 17-30 times heavier in the downlink than the uplink); Al Jette, Head of North American & cdma/4G Standards, Nokia Siemens Networks, “FCC Forum on the Future of Wireless Band Plans,” at 2-3, FCC Forum on the Future of Wireless Band Plans, July 16, 2012, available at <http://transition.fcc.gov/bureaus/oet/tac/tacdocs/meeting71612/PANEL2.1-Jette-NokiaSiemensNetworks.pdf> (indicating that downlink traffic is 6-13 greater than uplink traffic); Comments of Alcatel-Lucent, WT Docket Nos. 12-70, 05-356 and ET Docket no. 10-142, at 17 (filed May 17, 2012) (“The average traffic payload in wireless networks appear to be increasingly ‘downlink heavy’ by a factor of about 8 to 1. That is to say, about 85 to 95% of usable end-user bits are transmitted to the subscriber. Forecasts indicate that streaming video to subscribers will likely continue to grow in importance, while uplink traffic grows less rapidly.”);

technologies have adopted approaches that permit an operator to adjust how much of the capacity of the TDD channel is devoted to uplink versus downlink mode. If implemented in the 600 MHz Band, a TDD allocation offers the most spectrally efficient use of the spectrum – allowing more traffic in the downlink direction per megahertz than FDD.<sup>38</sup> While the Commission has proposed dedicating unpaired “supplemental downlink” spectrum blocks to address this traffic asymmetry,<sup>39</sup> TDD provides a more spectrally efficient approach that enables operators to change the asymmetry ratio (the ratio of capacity devoted to downlink and uplink traffic) in the event traffic demands change in the future, all while retaining the original band plan.<sup>40</sup>

Addressing asymmetry through a supplemental FDD downlink approach could actually *magnify* spectrum aggregation problems and *depress* auction revenues. In the event additional spectrum is made available, TDD allows its bi-directional use by *any* operator – the channel does not need to be paired with any other spectrum. By contrast, increasing the asymmetry ratio through supplemental downlink within an FDD allocation makes sense only for operators already possessing spectrum with similar propagation characteristics – that is, only operators that have

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*Service Rules for the Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands*, Report and Order and Order of Proposed Modification, WT Docket Nos. 12-70, 04-356, ET Docket No. 10-142, at ¶¶ 53, 80 (rel. Dec. 17, 2012) (“Not all spectrum use has equal value or leads to the same public interest benefits. For example, as explained below, wireless providers tend to use more downlink than uplink spectrum...To this end, we observe that mobile broadband uses far more downlink than uplink spectrum.”)

<sup>38</sup> For example, Clearwire and other BRS/EBS operators in the United States use an approach that provides approximately 60% of the traffic capacity in the downstream direction and 40% in the upstream direction. For an FDD deployment to similarly match this asymmetry, the Commission would need to assign 50% more spectrum for downlink than for uplink. Such an action, however, could undermine the Commission’s most important goal of providing the maximum amount of spectrum possible for multiple operators.

<sup>39</sup> *Notice* at ¶ 134.

<sup>40</sup> To be sure, TDD operators must agree on asymmetry ratios and synchronize their transmissions in order to avoid adjacent-channel interference in the absence of guard bands. While a slight disadvantage of TDD, coordination in no way serves as an obstacle to TDD deployment. Operators routinely coordinate to avoid interference in current *FDD* allocations. Moreover, in indoor small cell deployments their ratios could conceivably be adjusted without extensive coordination.

either acquired a paired 600 MHz license or that have 700 MHz licenses.<sup>41</sup> Supplemental downlink, compared to TDD, results in less bi-directional spectrum that can be utilized by the greatest number of operators and limits the operator's ability to adjust their spectrum use should the balance of uplink and downlink data traffic change in the future. As a result, the Commission would likely depress auction revenues for this spectrum by constraining spectrum solely for supplemental downlink use.

The Commission's detailed discussion in the *Notice* of the many different FDD band plan proposals makes it clear that adopting an FDD approach that addresses the Commission's challenges and objectives will be difficult. As spectrum not naturally paired, nor necessarily conducive to pairing without sacrificing valuable spectrum, the 600 MHz Band provides an ideal band for TDD. TDD affords the Commission significantly more flexibility, creating spectrum suitable for asymmetrical bi-directional traffic without the unnecessary spectrum constraints associated with an FDD allocation.

## **B. Proposed TDD Band Plan**

As the Commission has repeatedly acknowledged, competition is a prerequisite to truly unleashing innovation and investment from wireless technologies.<sup>42</sup> The effect sub-1 GHz spectrum has on wireless competition was emphasized in the Commission's 2011 *AT&T-Qualcomm Order*, in which the Commission found such spectrum to have "technical attributes important for other competitors to meaningfully expand their provision of mobile broadband

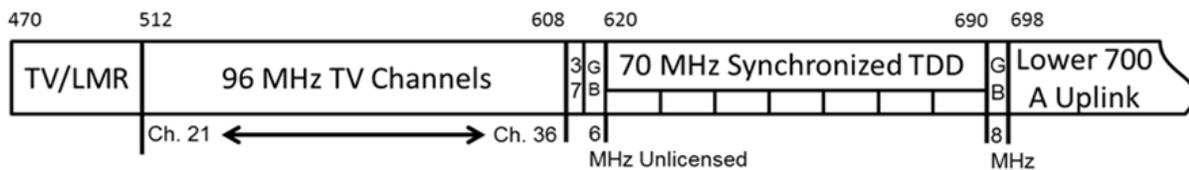
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<sup>41</sup> As previously alluded to, AT&T and Verizon control the overwhelming majority of 700 MHz spectrum, particularly in the most congested markets where additional downlink capacity is most needed.

<sup>42</sup> See, e.g., *Spectrum Holdings NPRM* at ¶ 4 ("Ensuring the availability of sufficient spectrum is critical for promoting the competition that drives innovation and investment."); *Fifteenth Competition Report* at ¶ 156 ("The structural and behavioral characteristics of a competitive market are desirable not as ends in themselves, but rather as a means of bringing tangible benefits to consumers such as lower prices, higher quality and greater choice of services."); *Fourteenth Competition Report* at ¶ 1 ("Competition has played and must continue to play an essential role in mobile – leading to lower prices and higher quality for American consumers, and producing new waves of innovation and investment in wireless networks, devices, and services.").

services or for new entrants to have a potentially significant impact on competition.”<sup>43</sup> Given the paucity of sub-1 GHz spectrum, ensuring competition *within* these low frequency bands is essential to promoting the competition (and innovation and investment) that depends on these bands.

Sprint believes that a contiguous TDD allocation expanding from Channel 51 downwards would address most of the Commission’s objectives better than an FDD approach, and would be more likely to provide more spectrum for competitive use than an FDD approach. Sprint proposes the following generic TDD band plan based on 10 megahertz blocks.



**Figure 1: Potential 600 MHz Band TDD Allocation**

This TDD band plan offers a number of important benefits. Foremost, it creates up to seven 10 megahertz-wide license blocks on the spectrum between TV channels 38 to 51, enabling multiple competitors to obtain 600 MHz spectrum.<sup>44</sup> Second, this approach permits operators to address their asymmetrical data traffic demand simply by adjusting the downlink to uplink ratio within their transmissions, avoiding the need to create additional channels for downlink only use.<sup>45</sup> Third, this band plan avoids interference problems with 700 MHz uplink transmissions and channel 37 operations (radio astronomy and WMTS) by establishing small

<sup>43</sup> *Application of AT&T Inc. and Qualcomm Inc.*, Order, 26 FCC Rcd 17589, ¶ 51 (2011) (*AT&T-Qualcomm Order*).

<sup>44</sup> This approach of providing seven license opportunities compares favorably with the band plans for PCS and AWS-1, which each provided six license blocks that led to increased competition in each band. In contrast, the 700 MHz band plan offered only four bi-directional license blocks (excluding the D Block) which essentially ended up almost exclusively in the hands of AT&T and Verizon Wireless.

<sup>45</sup> In order to avoid interference, all 600 MHz TDD licensees would need to agree on an appropriate asymmetry ratio and synchronize their transmissions, just as BRS and EBS licensees are already doing at 2.5 GHz.

guard bands that can be used by unlicensed devices.<sup>46</sup> Moreover, this band plan allows for simple expansion below TV channel 37 if additional spectrum is cleared (beyond the 84 megahertz from television channel 38 to 51),<sup>47</sup> and can be contracted if the Commission is unable to clear the entire 84 megahertz.<sup>48</sup>

In contrast, the FDD approaches proposed by the Commission and various commenters have several significant drawbacks when compared to the TDD band plan. First, an FDD approach is unlikely to offer as many opportunities for bi-directional licenses without requiring multiple band configurations and multiple duplexers within devices.<sup>49</sup> Second, no FDD plan is able to offer comparable flexibility for utilizing differing amounts of spectrum that may be cleared since such plans have to account for separate uplink, downlink, and duplexer gap spectrum blocks. Moreover, an FDD allocation likely will require use of multiple filters for any additional paired spectrum in the event that more than 60 megahertz is ultimately made available

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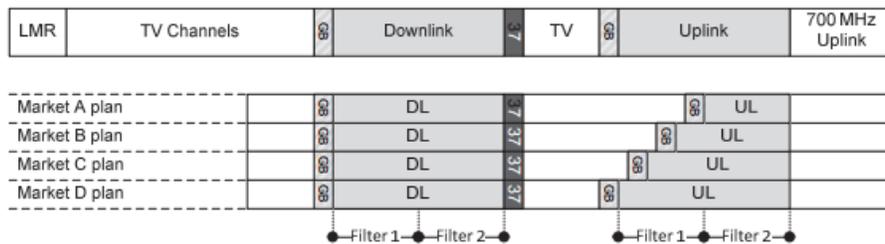
<sup>46</sup> Sprint supports the use of unlicensed white space devices in these guard bands. We note that white space devices typically operate on a TDD basis, creating a potential synergy for making higher scale devices that are designed to operate both in the 600 MHz TDD band as well as in television white spaces. The proposed guard band at 614-620 MHz would help avoid interference from 600 MHz TDD devices to television receivers, facilitating the design of low-cost filters that could be incorporated into television receivers. The proposed guard band at 690-698 MHz would enable 600 MHz TDD devices to incorporate adequate filtering to avoid interference from nearby 700 MHz Lower A Block device transmissions. It would also facilitate the use of filters on 600 MHz and 700 MHz base stations to avoid interference.

<sup>47</sup> Though the Commission has indicated its intent to begin a reverse auction with an aim of upwards of 120 megahertz, many projections assume a significantly more conservative amount of spectrum will be relinquished. See, e.g., Daniel Brenner and A.J. Burton, *Zeroing in on the U.S. digital one-ders: incentive auctions, cable digitization, and basic tier encryption*, Hogan Lovells Global Media & Communications Quarterly, at 18 (Spring 2012) (projecting that the incentive auctions will “likely yield only 60-80 MHz” of spectrum for mobile broadband use); Alton Burton, *New U.S. Spectrum Legislation*, Hogan Lovells International Spectrum Review (Feb. 28, 2012), available at <http://www.hlspectrumreview.com/2012/02/articles/spectrum-management/new-us-spectrum-legislation/> (“It now appears, however, that incentive auctions will likely yield only 60-80 MHz...”).

<sup>48</sup> Of course, guard bands would need to be shifted to avoid interference between television broadcast and mobile broadband operations.

<sup>49</sup> Those multiple band pairing approaches also open the door for interoperability and scale problems, as has occurred at 700 MHz.

for mobile broadband (assuming two paired blocks of 25 megahertz or larger and at least 10 megahertz for a duplex gap). This result only increases complexity and costs associated with market variation, as the Commission acknowledges.<sup>50</sup> It also raises the prospect of additional balkanization of a low-frequency band, to the detriment of smaller and rural operators. Specifically, with the possibility of two filters, larger operators like AT&T and Verizon are almost certain to aggressively bid for the higher-frequency paired spectrum, leaving the lower frequency spectrum to smaller and rural operators.



**Figure 7. Example of family requiring two filters**

**Figure 2: NPRM Depiction of FDD Band Plan Requiring Use of Two Filters<sup>51</sup>**

The result is likely to be a repeat of the Lower 700 MHz Band debacle, as smaller and rural operators with blocks supported by the lower frequency filter are deprived of the economies of scale enjoyed by AT&T and Verizon, whose devices are built to support only frequencies in their pass band.

Sprint recognizes that historically some parties have questioned the suitability of using TDD for mobile broadband operations. Many of those questions have been successfully addressed in recent years, and further refinements of TDD are likely to occur within the multi-year time frame during which mobile broadband service will be deployed in the 600 MHz Band. For example, concerns have been expressed in the past that adjacent channel interference could occur if one TDD device attempts to listen to its base station while a nearby TDD device transmits on an adjacent channel. As mentioned previously, operators have addressed these concerns by adopting common asymmetry ratios and synchronizing transmissions. Similarly,

<sup>50</sup> Notice at ¶ 142.

<sup>51</sup> Id. at ¶ 140.

operators can address concerns about “time of flight” – that is, how far the TDD transmission can be used – by agreeing on common parameters defined in the LTE standards.<sup>52</sup>

Sprint is aware the some parties in this proceeding are likely to raise concerns about potential third-harmonic interference occurring into the PCS downlink band (1930-1995 MHz) if 600 MHz devices are permitted to transmit on frequencies below 665 MHz (the mid-point of television channel 46).<sup>53</sup> Sprint, as a PCS licensee, is well aware that 600 MHz devices must not be designed in a way that causes widespread harmful interference to current communication services. At the same time, Sprint notes that the communications bands in use in the U.S. and around the world are expanding, and vendors always face challenges in designing equipment that minimizes the likelihood of such interference. Potential third-harmonic conflicts already exist in the U.S., and yet we have seen little evidence of such interference problems to date.<sup>54</sup> The solutions that work today to avoid interference in these situations are also likely to be effective for 600 MHz transmissions.

Sprint believes that the important goal of maximizing the amount of spectrum that can be made available to multiple operators should not be stymied by technical concerns that can be solved through equipment design and operating practice. Sprint also believes that any potential disadvantages of TDD are outweighed by the overall benefits of a TDD approach to the band: greater spectral efficiency, more spectrum for competitive operations, and greater flexibility to meet different band clearing results. Sprint also submits that TDD approaches compare favorably to FDD approaches at the device or user equipment (UE) level, particularly with future

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<sup>52</sup> Because a TDD base station transmits and receives in different time intervals, concerns have been raised that signaling parameters in early TDD standards could result in a TDD base station starting to transmit before it received the signal from a distance device (six miles or more away), where the “time of flight” of the transmission is longer than base station’s listening window. LTE standards now specify a parameter that can be adjusted so that an operator can increase the distance at which devices can be received.

<sup>53</sup> Others are also likely to raise concerns about the potential for inter-modulation interference under certain situations

<sup>54</sup> For example, the third harmonic of the 850 MHz cellular uplink bands falls into the BRS/EBS band, the third harmonic of the Lower 700 MHz B and C uplink blocks fall into the AWS-1 downlink band, and the third harmonic of Upper 700 MHz C uplink block falls into the DARS and WCS bands.

deployment of Voice over LTE (VoLTE), in which paired spectrum solely figures as a contrivance of legacy circuit-switched voice.<sup>55</sup> In modern UE designs, TDD offers favorable LTE feature parity in active vs. idle mode handovers, amplifier headroom, and switch/filter performance (FDD duplexer loss as a function of challenging duplex gaps in this band versus a single filter and switch losses with TDD). Unlike FDD operation, TDD can uniquely take advantage of explicit RF channel condition reciprocity to better estimate the RF channel and employ uplink switched mode transmit antenna diversity techniques to further improve on performance over FDD. Consequently, while base physical antenna performance for FDD versus TDD UE's remains similar, this benefit of TDD operation helps improve important performance metrics like battery life.

#### IV. CONCLUSION

With the release of this *Notice*, the Commission initiated development of what will likely become a critical and competitively-impactful allocation of low-band spectrum. Faced with a range of important and complex choices and decisions, the Commission should remain committed to its objective of maximizing the amount of mobile broadband spectrum that can be put to use by the greatest number of competitors. Within the context of the reverse auction, this will require important Commission decisions on bid options, repacking, and reimbursement. Within the context of the forward auction and repacking, this will involve decisions on timing, license information, the most appropriate band plan, and eligibility rules, among others. Efforts to increase bidder confidence will in each case improve participation, increase the amount of spectrum available to mobile broadband competitors, and enlarge the amount ultimately raised for the U.S. Treasury. Equally affecting revenue, the Commission's band plan should maximize the number of bi-directional channels available to competitors – creating vigorous competition for *more spectrum*, and ultimately promoting more innovation and economic opportunity. Sprint looks forward to engaging the Commission in its efforts.

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<sup>55</sup> As previously alluded to, FDD allocations archaically reflect legacy circuit-switched services, in which voice traffic, to remain simultaneously bi-directional, must be split between separate uplink and downlink frequencies. In an all-IP network, however, VoLTE will transmit all voice services as packets, obviating the need for frequency separation to ensure simultaneous bi-directionality.

Respectfully submitted,

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