THE BROKEN PROMISE OF THE 2.5 GHZ BAND

Repurposing Educational Spectrum Resources to Connect America's Schools and Libraries to Next Generation Internet Services

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Executive Summary

A 2010 survey commissioned by the Federal Communications Commission (FCC) found that nearly 80% of schools and libraries in the United States lack Internet connectivity that fully meets their current needs. In response, President Obama proposed the ConnectED initiative to provide 99% of American schools and libraries with Internet connectivity at speeds no less than 100 Mbps within the next five years. Most of the funding for this initiative is expected to come from universal service funds administered by the FCC through it E-rate program.

The current level of E-rate funding is far too limited to meet the President's goal, however, and a substantial increase in universal service funding would threaten the affordability of broadband services in rural areas and to low-income communities. These public interest constraints have prompted the FCC to ask the public for help in identifying additional sources of funding for educational broadband.

Strangely, the FCC has ignored an obvious source of at least $11 billion in educational funding for which the FCC already has ultimate authority: The 117.5 MHz of spectrum allocated for the Educational Broadband Service (EBS) in the 2.5 GHz band. This spectrum was allocated for education over 50 years ago, but has never been fully utilized for its intended purpose. During the last two decades, the FCC permitted Sprint to lease nearly all of this educational spectrum from our schools and use it almost exclusively for Sprint's commercial purposes. Though Sprint has a legal obligation to provide 5% of the spectrum's broadband capacity for use by schools holding 2.5 GHz spectrum licenses, a recent study indicates that Sprint is not meeting even this minimal obligation in good faith.

When the FCC created the Educational Broadband Service more than a decade ago, it was optimistic that its new rules would encourage efficient use of the spectrum for educational purposes and noted its intent to monitor progress toward this goal. Despite the FCC's efforts, its 2010 survey indicates that the Educational Broadband Service is incapable of meeting the educational broadband needs of our schools.

In a speech at the U.S. Chamber of Commerce last week, Masayoshi Son, Sprint's Chairman and CEO of its Japanese parent, Softbank, made a pitch for Sprint's proposed acquisition of T-Mobile. He showed a video during the speech demonstrating that Sprint has the technological capability to provide wireless broadband at 200 Mbps *right now* using spectrum in the 2.5 GHz band. That speed is double the President's *five year* goal of providing 100 Mbps to schools, but Sprint does not intend to actually deploy that capability *unless* regulators allow it to buy T-Mobile.

Sprint's decision to use its own inaction on spectrum licensed for educational purposes as leverage against the government would be unconscionable under any circumstances. But it is especially galling when the FCC is considering whether it should impose additional fees on consumer phone bills to pay for educational broadband services while Sprint sits on educational spectrum worth at least $11 billion.

Even if Sprint voluntarily agreed to deploy its 200 Mbps hardware, it still would not meet the President's ConnectED goal, because the vast majority of the new hardware's capacity would be sold to Sprint's commercial customers. Sprint's 2.5 GHz network would need to be twice as fast as

Google Fiber to offer a 100 Mbps connection at peak load using only the 5% of capacity it makes available to schools.

The 5% capacity requirement may have been adequate when the FCC created the Educational Broadband Service, but circumstances have since changed dramatically. It is now obvious that 5% of the spectrum's capacity is not enough to meet the connectivity needs of our schools and libraries in the 21st Century. When a wireless service is no longer capable of serving its intended purpose, the public interest requires that the FCC repurpose the spectrum or attempt to modify the rules in a manner that would serve the intended purpose.

Until recently, the FCC lacked the ability to repurpose this spectrum in a manner that would enhance educational connectivity while compensating existing educational licensees for relinquishing their spectrum rights. This problem was largely solved in 2012, when Congress authorized the FCC to conduct incentive auctions to facilitate the repurposing of spectrum.

This paper recommends repurposing the educational broadband spectrum for purely commercial use through an incentive auction. If the FCC were to repurpose the Educational Broadband Service spectrum for flexible-use on a purely commercial basis through an incentive auction, it could:

- Raise at least $11 billion to compensate current educational licensees and provide an additional source of funding for the E-rate program,
- Increase the value of existing commercial spectrum in the 2.5 GHz band,
- Assign spectrum white spaces in the 2.5 GHz band that have lain fallow for fifty years, and
- Allocate additional unlicensed spectrum if the FCC were to adopt a frequency division duplexed band plan with a duplex gap.

A portion of the auction revenues would be used to compensate existing educational licensees for relinquishing their spectrum rights. The remaining portion could be used to provide students nationwide with the the world-class Internet infrastructure envisioned by the ConnectED initiative on a revenue neutral basis without threatening other universal service policy goals.

Sprint and other commercial licensees in the 2.5 GHz band would benefit from the incentive auction as well. Although commercial licensees would not be entitled to any revenue from the auction of educational spectrum, repurposing the educational spectrum for purely commercial use and assigning the 2.5 GHz white spaces would enhance the value of existing commercial spectrum in the band. It would also give commercial mobile providers an opportunity to acquire additional 2.5 GHz spectrum licenses that are free of any educational obligations.

The result would be a win for schools and libraries, a win for commercial mobile providers, and a win for America's future.

ConnectED Initiative

The future success of the United States is dependent on our ability to prepare the next generation to participate meaningfully in the duties and rights of citizenship and to compete in a global economy that rewards innovation.[1] The ability to access, analyze, and communicate information effectively in the workplace and in public affairs is increasingly dependent on the use of digital devices and the Internet, which are

rapidly becoming essential to an educated citizenry. To retain our global competitive advantages and our national character, we must provide our students with opportunities to engage in learning experiences driven by the world's most advanced information technologies.

We are failing to provide these opportunities to most students in our classrooms today. According to a 2010 survey commissioned by the FCC, though nearly all schools and libraries are connected to the Internet, nearly 80% lack Internet connectivity that fully meets their current needs.[2] Most of these Internet connections support many concurrent users, yet only 10% of schools and libraries have broadband connections of 100 Mbps or greater.[3] As a result, the bandwidth available per student is often significantly below the minimum threshold defined as broadband by the FCC.[4]

Last year, President Obama introduced the ConnectED initiative to address this threat to our future success as a nation.[5] The ConnectED initiative established the following goals for digital education:

- Within 5 years, provide 99% of American schools and libraries with next-generation broadband at speeds no less than 100 Mbps with a target of 1 Gbps;
- Ensure every educator in America receives support and training to use technology to help improve student outcomes; and
- Allow teachers and students to take full advantage of feature-rich educational devices and software.

Their is widespread support for these goals,[6] but Congress has not appropriated new funds to achieve them.[7] In the absence of a new federal appropriation, the President has directed federal agencies to "make better use of existing funds to get Internet connectivity and educational technology into classrooms."[8]

E-Rate Program

The bipartisan Leading Education by Advancing Digital (LEAD) Commission has proposed that the Federal Communications Commission (FCC) fund the infrastructure envisioned by the ConnectED initiative through the FCC's existing E-rate program.[9] The LEAD Commission describes inadequate infrastructure as "the most immediate and expensive barrier to implementing technology in education" and believes E-rate is the "centerpiece of solving the infrastructure challenge."[10]

Current Level of E-Rate Funding

The LEAD Commission's proposal to rely on the E-rate program for funding ConnectED infrastructure appears overoptimistic. When the FCC established the E-rate program in 1997, it adopted an annual funding cap of $2.25 billion[11] (currently $2.4 billion adjusted for inflation).[12] The $2.25 billion cap was slightly lower than the estimated total cost of communications services eligible for E-rate funding in the fifth year of the program ($2.4 to $2.7 billion).[13] Based on this estimate, the FCC concluded that the cap "struck a reasonable balance" between the benefits of higher discounts to schools and libraries and the costs of creating larger funding mechanisms.[14] The FCC nevertheless acknowledged that it did not have any historical data for projecting how much support the E-rate program would require.[15]

Over a decade of experience administering the program indicates that the initial projections used to establish the cap in 1997 substantially

underestimated the costs of providing communications services to schools and libraries. The demand for E-rate funding has exceeded the cap every year since the inception of the program.[16] Last year schools and libraries sought in excess of $4.9 billion in E-rate funding — more than twice the annual cap.[17] It has been estimated that there is an additional $2 to 3 billion in unrecognized annual demand for E-rate funding due to the chronic inadequacy of funding, which discourages schools and libraries from incurring the costs of submitting applications.[18] This indicates there is currently an annual E-rate funding shortfall of at least $2.5 billion and as much as $5.5 billion.

Need for Additional E-Rate Funding

Refocusing E-rate funding on the next generation Internet infrastructure contemplated by the ConnectED initiative is likely to increase the demand of schools and libraries for E-rate funding and exacerbate existing funding shortfalls.[19]

The FCC has proposed to address this issue by modernizing the program to new "2.0" standards.[20] The FCC notes that approximately $600 million annually could be redirected from outdated voice-telephony and paging services to new Internet infrastructure.[21] Reforms aimed at increasing administrative efficiency could redirect additional funds and reduce approximately $800 million in "funding gaps" caused by "red tape".[22] It is unlikely, however, that the expected $1.4 billion in annual "savings" would be sufficient to meet the ambitious goals of the ConnectED initiative.

Recent experience with federally funded broadband programs indicates that, even if all current E-rate funding were used exclusively and efficiently for the deployment of next generation Internet infrastructure to schools and libraries, it would not be enough to connect 99% of American schools and libraries within five years.

The Recovery and Reinvestment Act of 2009 appropriated $4.7 billion for the National Telecommunications and Information Administration (NTIA) to establish the Broadband Technology Opportunities Program (BTOP), which was intended to increase broadband access and adoption.[23] In 2010, NTIA provided approximately $3.5 billion in federal grant funding to 123 infrastructure projects in areas encompassing approximately 40 million households.[24] NTIA focused these awards on the construction of "middle mile" fiber infrastructure intended to serve "anchor institutions," i.e., schools, libraries, colleges, medical and healthcare providers, and public safety agencies, which included connections to 8,000 K-12 schools, community colleges, and universities.[25]

The Recovery and Reinvestment Act of 2009 also provided the Rural Utilities Service (RUS) with $2.5 billion to expand broadband access in rural America through the Broadband Initiatives Program (BIP).[26] The RUS committed approximately $3.5 billion in BIP funding in 2010 to deploy 49,255 miles of fiber and 684 wireless access points.[27] These deployments are improving broadband access to 168 "educational providers" and 79 libraries.[28]

Despite the commitment of approximately $7 billion in federal funding for broadband infrastructure, most schools and libraries continue to lack access to high-speed broadband connections capable of meeting their needs. Although BTOP and BIP funds were not used exclusively for schools and libraries, the relatively limited national impact of this funding on broadband access to these anchor institutions (BIP

funding improved access to only 79 libraries) indicates that $2.4 billion in annual E-rate funding would be inadequate to connect 99% of American schools and libraries to high speed broadband in only five years.

Many commenters in the FCC's E-rate 2.0 proceeding expect that additional funding will be necessary to connect America's schools and libraries to next generation Internet services. The Alliance for Excellent Education and more than forty other educational and civil rights organizations representing the vast majority of educational and library professionals have urged the FCC to increase E-rate funding.[29] They believe that ConnectED's goals "cannot be achieved without adding more funding to the E-rate program."[30]

Limitations on Additional E-Rate Funding

The need for additional E-rate funding is a significant obstacle to achieving the goals of the ConnectED initiative, because the FCC cannot expand E-rate using the program's existing funding mechanism without threatening other important policy goals.[31]

E-rate is part of a larger universal service program that is currently funded by "contributions" collected from communications services providers that typically pass these fees through to consumers on their monthly wireless and wired telephone bills.[32] These contributions are based on a percentage of certain communications services revenues (known as the "contribution factor") that is re-calculated by the FCC every quarter.

The contribution factor was once relatively low, but it has escalated rapidly in recent years, from 5.5% in 1988[33] to a high of 17.9% in the first quarter of 2012.[34] The overall amount of fees collected for the fund has risen correspondingly from $2.3 billion in 1998[35] to $8.7 billion in 2012.[36] The FCC has found that continued growth in the contribution factor would threaten the affordability of communications services.[37]

The FCC could attempt to mitigate this threat by increasing the proportion of universal service funding provided to the E-rate program without increasing the overall contribution factor. Most commenters in the FCC's E-rate 2.0 proceeding oppose this option, however, because it would require the diversion of funds from other universal service programs to E-rate — which could slow rural broadband deployment and limit the provision of lifeline services to low income households.

As a result of these constraints on universal service funding, the FCC has asked the public to identify additional sources of funding for the E-rate program.[38]

Educational Broadband Service

An ideal source of additional funding for E-rate 2.0 is the 117.5 MHz of spectrum allocated to the Educational Broadband Service in the 2.5 GHz band. This spectrum, which is designated primarily for educational use, has proven inadequate to meet the needs of our schools and libraries, but has substantial commercial value. If the FCC were to reassign EBS for exclusive commercial use through an incentive auction, it could raise approximately $11 billion in revenue to compensate existing EBS licensees and fund E-rate 2.0 without threatening the affordability of communications services, slowing rural broadband deployment, or limiting lifeline services.

Spectrum Allocations in the 2.5 GHz Band

Fifty years ago the FCC allocated 31 television channels (of 6 MHz each) from 2500 to 2690 MHz to the Instructional Television Fixed Service (ITFS) for the transmission of educational programming using the analog television broadcast standard.[39] The ITFS channels were allocated on a shared basis with the preexisting Operational Fixed Service (OFS) and International Control stations.[40]

When the FCC reevaluated the 2.5 GHz band in the early 1970s, it allocated 28 channels exclusively to the ITFS, 3 channels exclusively to the OFS, and deleted the allocation for International Control stations.[41]

The FCC reconsidered the ITFS allocation again in the early 1980s.[42] The FCC noted that, though most ITFS channels had been licensed in the largest metropolitan areas (e.g., New York, Los Angeles, Chicago), in many metropolitan and most rural areas there had been little or no ITFS use in the previous twenty years.[43] In contrast, there was growing demand for spectrum in the Multipoint Distribution Service (MDS), a wireless cable service operating on 2 channels in the 2.1 GHz band that was a potential competitor to wired cable systems.[44] To accommodate this demand, the FCC reallocated 8 ITFS channels to MDS.[45]

In the 1990s, the FCC reallocated the three Operational Fixed Service channels to MDS[46] and authorized both ITFS and MDS licensees to offer digital,[47] "two-way" services[48] in the 2.5 GHz band, including Internet access.[49] Despite these FCC efforts to modernize its rules governing MDS, most wireless cable systems were not commercially successful.

At the 2000 World Radiocommunication Conference, the United States identified the 2.5 GHz band for third generation (3G) mobile services (known internationally as IMT-2000).[50] FCC staff subsequently conducted an analysis of the 2.5 GHz band and concluded that (1) there was no readily identifiable alternate frequency band that could accommodate incumbent ITFS and MDS licensees, and (2) sharing between incumbents and 3G mobile services would not be practical.[51] Based on this analysis, the FCC declined to reassign the 2.5 GHz band for 3G services through competitive bidding.[52] The FCC instead opted to allow incumbent MDS licensees to transition their systems to advanced wireless services gradually.[53] The FCC added an allocation for mobile services to the 2.5 GHz band in 2001 and "committed to exploring service rules to permit mobile operations" in a future proceeding.[54]

The FCC initiated that proceeding in 2003[55] and adopted mobile service rules for the 2.5 GHz band a year later.[56] The new rules enabled 2.5 GHz licensees to transition the band from a television-centric, interleaved band plan with traditional site-based licensing to a mobile-centric, contiguous band plan with geographic area licensing.[57]

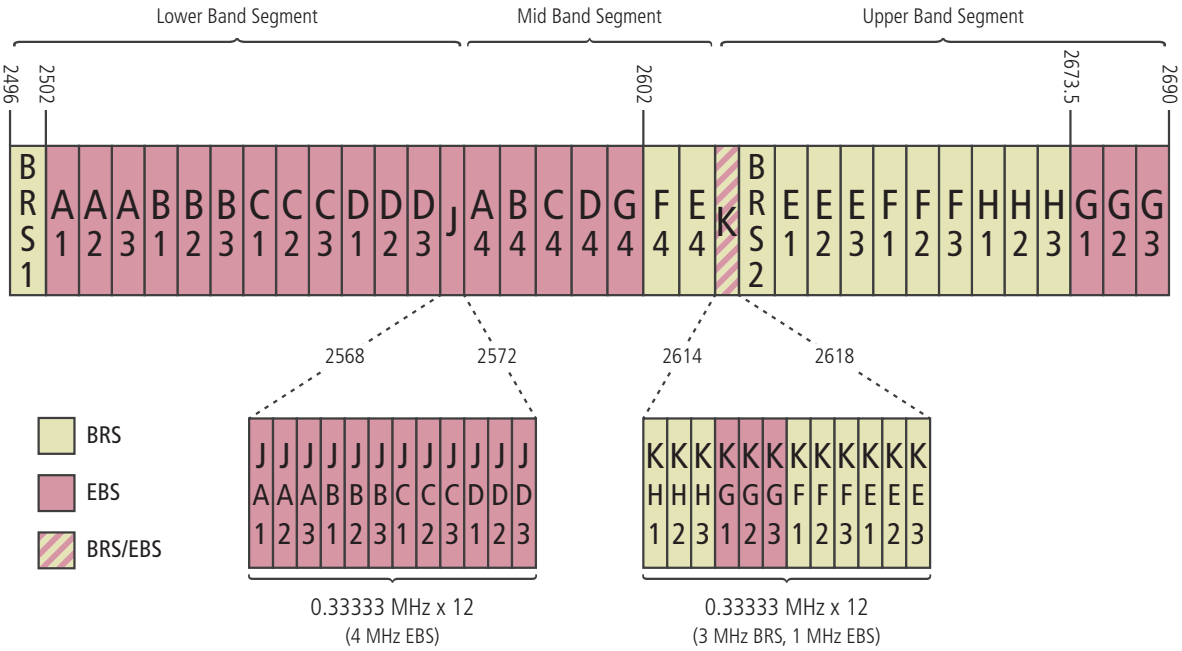
The new band plan is comprised of 194 MHz of spectrum (from 2496 to 2690 MHz[58]), of which 117.5 MHz is allocated primarily for educational use and 76.5 MHz is allocated for commercial use. This band plan is divided into three segments:

- The lower band segment, extending from 2496-2572 MHz, and comprised of twelve 5.5-megahertz-wide channels, one 6-megahertz-wide channel (BRS 1), and one 4-megahertz-wide guard band;

- The mid-band segment, extending from 2572-2614 MHz, and comprised of seven 6-megahertz wide channels; and
- The upper band segment, extending from 2614-2690 MHz, and comprised of twelve 5.5-megahertz wide channels, one 6-megahertz-wide channel (BRS 2), and one 4-megahertz-wide guard band.[59]

Only the mid-band segment is eligible for high power broadcast operations — the upper and lower band segments are limited to low power operations only.[60]

BRS/EBS Band Plan



To provide more accurate descriptions of the new mobile broadband services it anticipated would develop in the band, the FCC renamed the MDS as the "Broadband Radio Service" and the ITFS as the "Educational Broadband Service."[61]

Educational Use in the 2.5 GHz Band

When the ITFS was established in 1963, its primary purpose was to transmit educational television programming directly to accredited schools and colleges for the formal education of students.[62] To ensure licenses were used primarily for educational purposes, the FCC limited eligibility to hold an ITFS license to accredited educational institutions, governmental organizations engaged in the formal education of students, and non-profit organizations that provide educational services to such entities.[63]

When the FCC allocated 2.5 GHz spectrum to MDS in the early 1980s, it authorized ITFS licensees to lease "excess" capacity to wireless cable operators for non-educational purposes on a for-profit basis.[64] The FCC permitted leasing in order to generate revenue for additional educational programming and ITFS stations (which had been adversely impacted by declines in federal funding).[65] The FCC did not initially adopt any limitations on the non-educational use of ITFS spectrum or require that revenue generated through leasing be used for ITFS.[66]

After the FCC authorized for-profit leasing of educational spectrum, there was a significant increase in applications for new ITFS stations, primarily by nonlocal, nonprofit organizations.[67] The FCC concluded that this increased interest in ITFS spectrum "was clearly a result of the decision to permit the use of ITFS excess channel capacity for commercial purposes" and modified its rules to assure the preservation of ITFS.[68] Among other things, the FCC required a minimum "substantial use" of 20 hours per week per channel for educational programming before an ITFS channel could be used for non-educational purposes.[69]

The FCC subsequently declared that this "substantial use" requirement applied only once to each assigned 6 MHz ITFS channel even if the licensee used digital compression technologies capable of providing multiple programming streams within its assigned 6 MHz of bandwidth.[70]

In the early 1990s, the FCC determined that ITFS licensees could meet their educational usage requirement using a single 6 MHz channel, e.g., an ITFS licensee could move all of its ITFS programming on to one of its channels and lease the remaining channels on a twenty-four-hour basis to a wireless cable operator.[71]

As a result of these decisions, by the mid-1990s, ITFS operators were authorized to lease up to 95 percent of their spectrum capacity for commercial use.[72]

When the FCC reallocated the 2.5 GHz band for mobile services, it recognized that it had "progressively relaxed the educational content obligations of ITFS licensees" so that ITFS licensees could "lease all but a small fraction of their capacity to commercial operators" to generate income.[73] The FCC also acknowledged that overall utilization of the EBS spectrum was relatively low, and that few ITFS licensees used the band intensively for educational purposes.[74] The FCC nevertheless decided to retain the ITFS licensing regime for the new Educational Broadband Service in order to support the remaining educational services in the 2.5 GHz band.[75] The FCC remained optimistic that its revised rules would encourage EBS licensees to use their spectrum more efficiently and noted its intent to monitor their progress.[76]

EBS Approach Is Outdated

When the FCC established the Educational Broadband Service in 2004, it noted that the Internet could offer a "superior means" of delivering educational programming.[77] Although the FCC believed the Internet offered "interesting educational possibilities," it found that obstacles to infrastructure deployment precluded a shift to broadband Internet access for the delivery of educational content at the time.[78]

That finding was reasonable a decade ago, but not today. The goal of the President's ConnectED initiative is for the Internet to become the primary means of delivering educational content within the next five years at speeds no less than 100 Mbps. Though the 2.5 GHz band is physically capable of providing Internet access at that speed, the rules governing the Educational Broadband Service render it incapable of meeting the goals of the President's ConnectED initiative as a practical matter.

First, EBS licensees are required to reserve only 5% of their spectrum capacity for educational usage. An EBS licensee with a 5% usage reservation could meet the 100 Mbps target established by the ConnectED initiative during periods of peak load only if the 2.5 GHz network were capable of providing an overall speed of 2

Gbps — which is twice as fast as the Google Fiber network in Kansas City. This may be technically possible, but there is no evidence that Sprint or any other EBS lessee has plans to deploy such technologies.[79]

Second, there are no EBS licenses in substantial portions of the country, particularly in rural areas. The ITFS spectrum was licensed on a site-by-site basis, which resulted in white spaces similar to those in the commercial over-the-air television broadcast bands.[80] Although the FCC initiated a proceeding in 2003 to eliminate these white spaces,[81] it has never completed it. As a result, EBS spectrum could not be used to meet the goals of the ConnectED initiative or E-rate in vast swaths of the country even if EBS could meet the applicable speed targets.

Third, the EBS spectrum is licensed to particular schools, colleges, and nonprofit organizations. EBS licenses cover large geographic areas, including urban areas with numerous schools and libraries. It is only the particular EBS licensees, however, who are entitled to the the profit-generating lease revenue and 5% educational usage requirement. Most schools and libraries do not benefit from EBS.

It has become obvious that the current spectrum licensing approach to connecting schools and libraries is outdated. According to the FCC, nearly 80% of schools report that their communications needs are not being met fifty years after the FCC allocated spectrum for educational use in the 2.5 GHz band. The evidence thus indicates that EBS is not serving its original purpose. If it were, the ConnectED initiative and E-rate 2.0 would not be needed.

EBS Spectrum Has Substantial Commercial Value

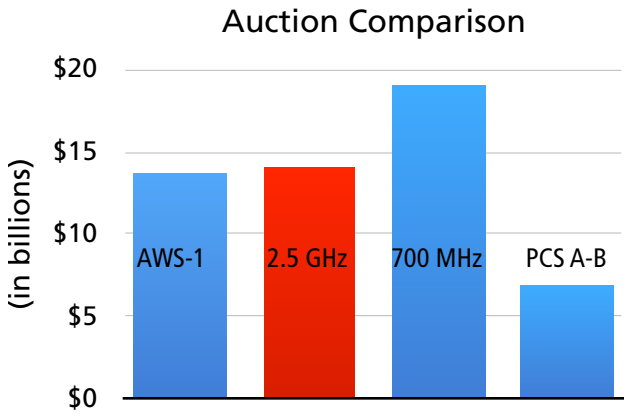
Though it has not been able to meet the communications needs of our schools and libraries, the EBS spectrum has substantial commercial value. Sprint has leased substantial amounts of EBS spectrum in major markets[82] for commercial use in its integrated tri-band LTE network.[83] According to Chief Executive Officer Dan Hesse, Sprint's 2.5 GHz spectrum will give it "extraordinary capacity" and provide "speed and performance advantages in the market."[84] Sprint is currently deploying 2.5 GHz radios that offer "improved coverage, capacity and speeds" compared to the radios used by its competitors, and has demonstrated 1 Gbps speeds in the lab using 2.5 GHz spectrum.[85] A recent analyst report concluded that Sprint's 2.5 GHz spectrum enables Sprint "to provide super high speed data connections" that will make it the "king of data speed."[86]

Although Sprint now acknowledges the competitive advantages provided by its substantial spectrum holdings in the 2.5 GHz band, it has previously argued that EBS spectrum is not commercially viable.[87] In 2008, the FCC agreed, finding that EBS spectrum is unsuitable for commercial mobile use because, "The primary purpose of EBS is to further the educational mission of accredited public and private schools, colleges and universities."[88] Assuming this finding was reasonable at that time, the behavior of EBS licensees and Sprint have since invalidated it.

Earlier this year Sprint published a white paper (Sprint Paper) to support its acquisition of the 50% of Clearwire it did not already own for $2.2 billion.[89] The Sprint Paper asserted that FCC regulations governing EBS spectrum reduce its

commercial value substantially as compared to other mobile spectrum bands.[90] It estimated that the 2.5 GHz band spectrum was worth only $0.05 to $0.14 per MHz-pop due primarily to the eligibility restriction on EBS ownership (i.e., it cannot be licensed directly to commercial entities) and the EBS white spaces.[91] This unusually low valuation sparked a bidding war with DISH Network, which ultimately revealed that Sprint valued Clearwire's 2.5 GHz spectrum at $14 billion (approximately $0.30 per MHz-pop).[92]

The following hypothetical provides some perspective regarding this valuation. If we assume that the FCC had auctioned Clearwire's 2.5 GHz spectrum for $14 billion in net bids, this hypothetical auction would rank as the second largest spectrum auction in FCC history by revenue — displacing the 2006 AWS-1 auction, which generated only $13.7 billion in net bids.



Based on this behavioral evidence, it is obvious that Sprint and other participants in the mobile market believe the EBS spectrum is suitable for commercial mobile use. If EBS spectrum were unsuitable for use in Sprint's mobile business, its investors would not have approved the acquisition of Clearwire's 2.5 GHz spectrum for $14 billion — more than every bidder combined paid in the AWS-1 auction.

Limitations on Commercial Use of EBS Spectrum

Despite the success of commercial licensees in the 2.5 GHz band, the Sprint Paper raised several concerns regarding certain FCC rules governing the licensing and use of EBS spectrum:

- The EBS eligibility restriction;
- The EBS white spaces; and
- The 5% educational programming requirement.[93]

According to Sprint, these rules substantially reduce the commercial value of its spectrum in the 2.5 GHz band, particularly its EBS spectrum.

Assuming these rules would tend to reduce the 2.5 GHz band's value, any such reduction in value has not rendered the spectrum unsuitable for commercial mobile services. A detailed analysis indicates that Sprint's concerns are either (1) remediable by the FCC or (2) have relatively minimal impact on the spectrum's overall value.

Eligibility Restriction

The Sprint Paper asserts that the EBS eligibility restriction (i.e., commercial entities cannot directly hold EBS licenses) reduces the value of EBS spectrum due to the transaction costs involved in managing spectrum leases and the risk that such leases might not be renewed.[94]

There are undoubtedly transaction costs involved in leasing spectrum, but such costs are not unique to EBS. Spectrum leasing is common in other mobile spectrum bands (*e.g.*, the PCS band) with similar constraints on renewal.

There is also no indication that transaction costs or renewal risks related to EBS spectrum leases are so high as to render the spectrum unsuitable for commercial mobile use. Sprint has already executed long-term *de facto* spectrum leases with most EBS licensees in major markets.[95] As of September 30, 2012, the weighted average of the remaining terms of Sprint's EBS leases was approximately 22 years[96] — more than twice the typical FCC license term for mobile spectrum (10 years). As the Sprint Paper acknowledged, "For a lease term of 22 years, the difference between the present value of an owned license and a leased license is small."[97]

The available evidence thus indicates that the EBS eligibility restriction has not substantially impaired Sprint's ability to use the spectrum for commercial mobile services.

EBS White Spaces

The Sprint Paper also asserts that the commercial value of leased EBS spectrum is reduced by its limited licensed coverage (i.e., the EBS white spaces) compared to the BRS spectrum (which does not have white spaces).[98] According to the Sprint Paper, the inconsistencies in potential coverage between the BRS and EBS portions of the band make it unsuitable for frequency division duplexed (FDD) technologies, and FDD spectrum has historically been valued more highly than spectrum suitable only for the time division duplexed (TDD) technologies Sprint is deploying in the 2.5 GHz band.[99]

Of course, the FCC could resolve this concern immediately by completing its decade-old rulemaking proceeding to license the EBS white spaces. If the continuing existence of EBS white spaces were substantially devaluing Sprint's 2.5 GHz spectrum, Sprint would be urging the agency to act. But a brief review of the FCC record in the EBS white spaces proceeding indicates that Sprint has not been active in the proceeding during the last year.[100] Based on Sprint's actual behavior, it appears this is not a substantial concern.

Five Percent Educational Usage Requirement

The Sprint Paper mentioned the 5% educational programming requirement, but did not discuss it in any detail. One possible reason for the lack of discussion regarding this requirement is that it would tend to reduce the value of EBS spectrum by a correspondingly minimal amount (*i.e.*, approximately 5%). Another possible reason is that, in practice, the 5% requirement has had little to no actual impact on the commercial value of EBS spectrum.

According to the Consortium for Public Education and the Roman Catholic Diocese of Erie, Pennsylvania (the "Public Education Consortium"), the FCC has not required Sprint to comply with the 5% educational programming requirement.[101] The Public Education Consortium analyzed FCC "substantial service" filings for every EBS license (127 total) leased by Sprint in 20 commercially deployed markets.[102] Sprint's FCC filings indicated that there has been no educational usage of EBS spectrum for 96 of the 127 licenses surveyed.[103] The educational usage for the remaining 31 licenses was very limited (with educational users typically constituting less than one-tenth of one percent of Sprint's 2.5 GHz subscribers).[104]

The Public Education Consortium also reviewed a publicly available EBS spectrum lease that Sprint entered into with the School Board of Pinellas County, Florida, in May 2010. The lease gives Sprint the right to use 100% of the EBS spectrum

and requires the school district to provide 6 months notice prior to deploying its own educational facilities (assuming any such facilities could be deployed without harmful interference to Sprint's network).[105] Alternatively, the lease provides that the school district can elect to purchase wireless broadband services and devices from among Sprint's standard retail service offerings using a "monthly service credit" that is deducted from Sprint's monthly lease payment back to the school district.[106] This "use it or lose it" credit is $1,000 in the first year of the lease and $2,537 in year 30 (the year 2040).[107]

The Public Education Consortium notes that, at an approximate retail value of $50 per wireless connection, the first year's credit would yield only 20 wireless connections for educational use, notwithstanding the fact that the Pinellas County School District is the 7th largest school district in the State of Florida and the 26th largest school district in the United States, with:

- 17,000 staff;
- 104,000 pre-K through 12th-grade students;
- 11,833 students in adult education centers; and
- 7,236 students in technical education centers.[108]

"With only 20 accounts to which it is entitled under the [Sprint] Lease (that the licensee must buy) for its purported 5% capacity reservation, the school district does not have available even a fraction of a fraction of the capacity or accounts it needs to serve its school district, let alone for any other educational or nonprofit purposes in the Tampa, Florida metropolitan area served by [Sprint]."[109]

To the extent the Pinellas County School District lease is representative of other arrangements intended to fulfill the FCC's 5% educational usage requirement, it appears the requirement imposes little to no cost on Sprint and results in little to no educational usage of the spectrum.

EBS Incentive Auction

The above analysis indicates that the Educational Broadband Service is not capable of meeting the needs of our schools and libraries in the 21st Century. It also indicates that, despite its commercial success in the 2.5 GHz band, Sprint is dissatisfied with the educational requirements that remain applicable to EBS. In these circumstances, the public interest would be best served by repurposing the spectrum for purely commercial services.

In the past, the FCC lacked the ability to repurpose this spectrum in a manner that would enhance educational connectivity universally while compensating existing EBS licensees for relinquishing their spectrum rights. That changed in 2012 when Congress granted the FCC authority to conduct incentive auctions.[110] Section 309(j)(8) of the Communications Act, as amended, provides that the FCC may encourage a licensee to relinquish voluntarily some or all of its licensed spectrum usage rights in order to permit the assignment of new initial licenses subject to flexible-use service rules by sharing with such licensee a portion of the auction proceeds.[111] The portion paid to the licensee is determined by a reverse auction in which the licensee indicates the compensation it would accept in return for voluntarily relinquishing its spectrum rights.[112]

If the FCC were to reallocate and reassign the EBS spectrum through an incentive auction for flexible-use on a purely commercial basis, it could:

- Raise approximately $11 billion to compensate EBS licensees and modernize America's schools and libraries with high-speed Internet services,
- Increase the value of existing commercial spectrum in the 2.5 GHz band,
- Assign spectrum white spaces in the 2.5 GHz band that have lain fallow for fifty years, and
- Allocate additional unlicensed spectrum in 2.5 GHz guard bands or a duplex gap.

Funding Next Generation Internet Services for Schools and Libraries

If the FCC were to reassign the EBS spectrum for flexible-use on a purely commercial basis, EBS licensees could use their auction compensation to acquire the world-class Internet infrastructure envisioned by the ConnectED initiative, and the additional auction proceeds could be used to fund E-rate 2.0.

As discussed above, the President's goals for the ConnectED initiative cannot be achieved without additional funding to the E-rate program, and the FCC cannot provide additional E-rate funding through the program's existing funding mechanism without threatening other important policy goals. An incentive auction of EBS spectrum could provide substantial additional funding for E-rate on a revenue-neutral basis without compromising any other policy goals.

Assuming the 117.5 MHz of EBS spectrum sold for at least the $0.30 per MHz-pop price that Sprint paid for its 2.5 GHz spectrum, an EBS incentive auction would raise nearly $11 billion that could be used to connect America's schools and libraries to next generation Internet services.[113] If this funding were spread over the five-year period envisioned for completion of the ConnectED initiative, it would provide approximately $2.18 billion in incentive auction compensation and additional E-rate funding yearly — nearly double the amount of annual funding that is currently allotted to the E-rate program.

The FCC already has authority to conduct an EBS incentive auction. It would need Congressional authorization, however, to deposit the excess proceeds from an incentive auction of EBS spectrum in the E-rate fund. This authorization would require a relatively simple amendment to existing legislation and would be revenue neutral.

Increasing the Commercial Value of Spectrum in the 2.5 GHz Band

The proposed EBS incentive auction would also eliminate Sprint's concerns regarding the potential for EBS limitations to reduce the commercial value of the 2.5 GHz band. The EBS eligibility restriction, 5% educational usage requirement, and EBS white spaces would all be eliminated, which would tend to increase the commercial value of Sprint's commercial spectrum in the 2.5 GHz band. An EBS incentive auction would relieve Sprint of its obligation to make future lease payments that would otherwise have been due to EBS licensees that participate in the incentive auction.

Assigning the EBS White Spaces

A joint industry analysis indicates that there are, on average, EBS white spaces in 800 counties across the United States.[114] In many of these counties, EBS spectrum has lain fallow for the last fifty years. An incentive auction would eliminate the EBS white spaces and put this spectrum to use for the benefit of the public while ensuring that the benefits of this spectrum are realized by the schools and libraries that need federal assistance the most.

Allocating Additional Unlicensed Spectrum

An EBS incentive auction would also provide the FCC with an opportunity to rationalize the 2.5 GHz band plan by eliminating the high power middle band segment and consolidating the guard bands. It would be possible to harmonize the U.S. band plan with the CEPT/CITEL band plan adopted in Europe and Latin America, which would facilitate international roaming.

The CEPT/CITEL band plan provides paired FDD frequencies at the edges of the band plan and an unpaired FDD/TDD frequencies in the middle. The paired and unpaired frequencies are typically separated by guard bands of at least 5 MHz. If the FCC were to adopt a similar approach, it could allocate the 2.5 GHz guard bands for unlicensed use. Alternatively, the FCC could adopt a paired band plan and allocate the duplex gap for unlicensed use.

Conclusion

The revenue produced by an EBS incentive auction could be used to fund the ConnectED initiative and E-rate 2.0 without threatening other policy goals. EBS licensees would receive compensation for relinquishing their spectrum rights, the value of spectrum held by commercial licensees would increase, additional unlicensed spectrum could be created, and additional spectrum would be licensed in rural areas where 2.5 GHz spectrum has lain fallow for half a century. Most importantly, an EBS incentive auction would enable more students to access high speed Internet connections for the first time.

[1] *See* OECD, OECD Skills Outlook 2013: First Results from the Survey of Adult Skills (2013), http://dx.doi.org/10.1787/9789264204256-en.

[2] *See* FCC, 2010 E-Rate Program and Broadband Usage Survey, Report, DA 10-2414, 26 FCC Rcd. 1 at 2 (2011).

[3] *See id*.

[4] *See* Charles M. Davidson and Michael J. Santorelli, The Impact of Broadband on Education, A Study Commissioned by the U.S. Chamber of Commerce at 16 (2010), available at http://www.uschamber.com/sites/default/files/about/US_Chamber_Paper_on_Broadband_and_Education.pdf.

[5] *See* ConnectED Fact Sheet, available at http://www.whitehouse.gov/sites/default/files/docs/connected_fact_sheet.pdf.

[6] *See, e.g.*, State Educational Technology Directors Association (SETDA), The Broadband Imperative: Recommendation to Address K-12 Educational Infrastructure Needs at 10 (May 21, 2012), http://www.setda.org/web/guest/broadbandimperative. (SETDA Recommendation).

[7] *See* Danielle Kehl and Sarah Morris, *Bad Connection: Obama wants to bring better broadband to schools. But how will he pay for it?*, SLATE (Jun. 18, 2013), available at http://www.slate.com/articles/technology/future_tense/2013/06/connected_plan_for_school_broadband_sounds_great_but_we_need_more_details.1.html.

[8] *See* Megan Slack, *What is ConnectED?*, THE WHITE HOUSE BLOG (Jun. 6, 2013), available at http://www.whitehouse.gov/blog/2013/06/06/what-connected.

[9] *See* LEAD Commission, Paving a Path Forward for Digital Learning in the United States at 2, available at http://www.leadcommission.org/news/lead-commission-unveils-digital-learning-blueprint.

[10] *See id*.

[11] *See* Federal-State Joint Board on Universal Service, Report and Order, FCC 97-157, 12 FCC Rcd. 8776 at ¶ 425 (May 7, 1997) (First E-Rate Order).

[12] The FCC began indexing the cap to inflation in 2010. *See* Schools and Libraries Universal Service Support Mechanism, Sixth Report and Order, FCC 10-175, 25 FCC Rcd. 18762 at ¶ 36 (2010) (Sixth E-Rate Report and Order).

[13] *See* First E-Rate Order at ¶¶ 529-534. The FCC estimated that the total cost of the telecommunications services eligible for discounts would be approximately $3.1 to $3.4 billion annually during an initial four-year deployment period and approximately $2.4 to $2.7 billion annually in subsequent years. *See id*. at ¶ 531.

[14] *See id*. at ¶ 533.

[15] *See id*. at ¶ 530.

[16] *See* Modernizing the E-Rate Program for Schools and Libraries, Notice of Proposed Rulemaking, FCC 13-100, 28 FCC Rcd. 11304, at ¶ 9 (Jul. 23, 2013) (E-Rate Modernization NPRM). *But see* Sixth E-Rate Report and Order at ¶ 34 (stating that "the demand for E-rate funding has exceeded the amount available in every year but one").

[17] *See* E-Rate Modernization NPRM at ¶ 9.

[18] *See* Comments of CSM, Inc., FCC, WC Docket No. 13-184 at 7 (Sep. 16, 2013).

[19] *See, e.g.*, Statement of Commissioner Jessica Rosenworcel, E-Rate Modernization NPRM at 169 ("Let's be honest. [The] needs [of schools and libraries for broadband services] are only going to grow").

[20] *See generally*, E-Rate Modernization NPRM, WC Docket No. WC 13-184.

[21] *See* Statement of Commissioner Ajit Pai, E-Rate Modernization NPRM at 173.

[22] *See id*. at pp. 173-74.

[23] *See* American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115, Titles II and VI (2009), available at http://www.gpo.gov/fdsys/pkg/PLAW-111publ5/pdf/PLAW-111publ5.pdf. Congress rescinded $302 million from the BTOP, which reduced its funding to approximately $4.4 billion. *See* Pub. Law No. 111-226, 124 Stat. 2389 at § 302 (2010), available at http://www.gpo.gov/fdsys/pkg/PLAW-111publ226/pdf/PLAW-111publ226.pdf.

[24] *See* NTIA, Expanding Broadband Access and Adoption in Communities Across America at 3 (Dec. 14, 2010) (BTOP Report), available at http://www.ntia.doc.gov/report/2010/expanding-broadband-access-and-adoption-communities-across-america-overview-grant-awards. *See also* NTIA, Broadband Technology Opportunities Program (BTOP) Quarterly Program Status Report at 1 (Oct. 29, 2013), available at http://www.ntia.doc.gov/report/2013/eighteenth-quarterly-status-report-congress-regarding-btop.

[25] *See* BTOP Report at 3-4, 10.

[26] *See* RUS, Status of Broadband Initiatives Program As of 8/26/13 at 1, available at http://www.rurdev.usda.gov/Reports/utpRUSBIPStatusReport_Q32013.pdf.

[27] *See id*. at 2.

[28] *See id*.

[29] *See* Letter from Alliance for Excellent Education, et al., to Chairwoman Clyburn, Commissioner Rosenworcel, and Commissioner Pai, FCC, WC Docket No. 13-184 at 2 (Sep. 16, 2013), available at http://apps.fcc.gov/ecfs/comment/view?id=6017467521.

[30] *See* Comments of the American Library Association, WC Docket No. 13-184 at 3 (Sep. 16, 2013), available at http://apps.fcc.gov/ecfs/comment/view?id=6017467492.

[31] *See* Connect America Fund, Report and Order and Further Notice of Proposed Rulemaking, FCC 11-13 at ¶ 124 (2011) (CAF Order).

[32] *See id*.

[33] *See* Statement of Commissioner Robert McDowell, Connect America Fund, Notice of Proposed Rulemaking and Further Notice of Proposed Rulemaking, FCC 11-13 (2011) (CAF NPRM).

[34] *See* Proposed First Quarter 2012 Universal Service Contribution Factor, Public Notice, DA 11-2020 (2011).

[35] *See* Statement of Commissioner Meredith Atwell Baker, CAF NPRM.

[36] *See* 2012 Annual Report, Universal Service Administration Company at 1, available at http://www.usac.org/_res/documents/about/pdf/annual-reports/usac-annual-report-2012.pdf.

[37] *See* CAF Order at ¶ 124.

[38] *See* E-Rate Modernization NPRM at ¶¶ 163-176.

[39] *See* Amendments of Parts 2 and 4 of the Commission's Rules and Regulations to Establish a New Class of Educational Television Service for the Transmission of Instructional and Cultural Material to Multiple Receiving Locations on Channels in the 1990-2110 Mc/s or 2500-2690 Mc/s Frequency Band, Report and Order, 39 FCC 846, ¶¶ 15, 39, App. §§ 4.902(a), 4.938 (Jul. 25, 1963) (ITFS Allocation Order). The FCC chose the 2.5 GHz band over the 1990 to 2110 MHz band because (1) the "propagation characteristics are essentially the same in either band," (2) ITFS could be implemented with the least disruption to existing services in the 2.5 GHz band, and (3) the wider bandwidth available in the 2.5 GHz band could accommodate more channels. *See id*. at ¶¶ 15.

[40] *See id*. at ¶ 16, App. § 4.902(b).

[41] *See* Amendment of Parts 2 and 74 of the Commission's Rules and Regulations to Establish a New Class of Educational Television Service for the Transmission of Instructional and Cultural Material to Multiple Receiving Locations on Channels in the 2500-2690 MHz Frequency Band, Second Report and Order, FCC 71-600, 30 FCC 2d 197 at ¶¶ 12-13 (Jun. 14, 1971).

[42] *See* Amendment of Parts 2, 21, 74 and 94 of the Commission's Rules and Regulations in regard to frequency allocation to the Instructional Television Fixed Service, the Multipoint Distribution Service, and the Private Operational Fixed Microwave Service, Report and Order, FCC 83-243, 94 FCC 2d 1203 (Jul. 15, 1983) (ITFS Reallocation Order).

[43] *See id*. at ¶¶ 19, 54.

[44] *See* Amendment of Parts 21 and 74 of the Commission's Rules with Regard to Filing Procedures in the Multipoint Distribution Service and in the Instructional Television Fixed Service, Report and Order, 10 FCC Rcd. 9589, 9592-93, ¶ 6 (Jun. 30, 1995) (MDS Auction Order).

[45] *See* ITFS Reallocation Order at ¶ 4. Note that, although MDS channels in the 2.5 GHz band were designated as Multichannel Multipoint Distribution Service (MMDS) channels (because they enabled the use of multiple MDS channels on a nationwide basis for the first time), this paper refers to both MDS and MMDS channels as MDS channels. At this point, the 2.5 GHz band was comprised of 20 ITFS channels, 8 MDS channels, and 3 OFS channels.

[46] *See* Amendment of Parts 21, 43, 74, 78, and 94 of the Commission's Rules Governing Use of the Frequencies in the 2.1 and 2.5 GHz Bands Affecting: Private Operational-Fixed Microwave Service, Multipoint Distribution Service, Multichannel Multipoint Distribution Service, Instructional Television Fixed Service, and Cable Television Relay Service, Second Report and Order, FCC 91-302, 6 FCC Rcd. 6792 (Oct. 25, 1991). As a result, MDS was allocated 11 channels in total.

[47] *See* Request for Declaratory Ruling on the Use of Digital Modulation by Multipoint Distribution Service and Instructional Television Fixed Service Stations, Declaratory Ruling and Order, 11 FCC Rcd. 18839 (1996) (authorizing 2.5 GHz licensees to to employ digital technologies).

[48] *See* Amendment of Parts 21 and 74 to Enable Multipoint Distribution Service and Instructional Fixed Television Service Licensees to Engage in Fixed Two-Way Transmissions, Report and Order, FCC 98-231, 13 FCC Rcd. 19112 (Sep. 25, 1998) (Two-Way Order).

[49] *See* The Mass Media Bureau Implements Policy for Provision of Internet Service on MMDS and Leased ITFS Frequencies, Public Notice, 11 FCC Rcd. 22419 (1996) (authorizing high-speed digital data applications in the band, including Internet access).

[50] *See* 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, Notice of Proposed Rule Making, FCC 00-455, 16 FCC Rcd. 596, ¶ 4, n.10 (2001).

[51] *See* FCC, Spectrum Study of the 2500-2690 MHz Band: The Potential for Accommodating Third Generation Mobile Systems, Final Report, ET Docket No. 00-258 at i-iii (Mar. 30, 2001), available at http://transition.fcc.gov/3G/3gfinalreport.pdf.

[52] *See* Amendment of the U.S. Table of Frequency Allocations to Designate the 2500-2520/2670-2690 MHz Frequency Bands for the Mobile-Satellite Service, First Report and Order and Memorandum Opinion and Order, FCC 01-256, 16 FCC Rcd. 17222, ¶¶ 19-20 (2001) (2.5 GHz Mobile Allocation Order). The FCC subsequently allocated frequencies for advanced wireless services in the 1.7 and 2.1 GHz bands. *See* 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, Second Report and Order, FCC 02-304, 17 FCC Rcd. 23193, 23193-94, ¶ 1 (Nov. 7, 2002).

[53] *See* 2.5 GHz Mobile Allocation Order at ¶ 2.

[54] *See* Amendment of Parts 1, 21, 73, 74 and 101 of the Commission's Rules to Facilitate the Provision of Fixed and Mobile Broadband Access, Educational and Other Advanced Services in the 2150-2162 and 2500-2690 MHz Bands, Notice of Proposed Rulemaking and Memorandum Opinion and Order, FCC 03-56, 18 FCC Rcd. 6722, ¶ 15 (Apr. 2, 2003) (BRS/EBS NPRM).

[55] *See id*.

[56] *See* Amendment of Parts 1, 21, 73, 74 and 101 of the Commission's Rules to Facilitate the Provision of Fixed and Mobile Broadband Access, Educational and Other Advanced Services in the 2150-2162 and 2500-2690 MHz Bands, Report and Order and Further Notice of Proposed Rulemaking, FCC 04-135, 19 FCC Rcd. 14165 (2004) (First BRS/EBS Order). *See also* Amendment of Parts 1, 21, 73, 74 and 101 of the Commission's Rules to Facilitate the Provision of Fixed and Mobile Broadband Access, Educational and Other Advanced Services in the 2150-2162 and 2500-2690 MHz Bands, Order on Reconsideration and Fifth Memorandum Opinion and Order and Third Memorandum Opinion and Order and Second Report and Order, FCC 06-46, 21 FCC Rcd. 5606 (2006) (reconsidering certain rules adopted in the First BRS/EBS Order) (Second BRS/EBS Order).

[57] *See* First BRS/EBS Report and Order at ¶¶ 21-22.

[58] The FCC extended the 2.5 GHz band from 2495 to 2500 MHz to accommodate the relocation of the original MDS channels from the 2.1 GHz band, which were displaced by the advanced wireless services allocation. *See id.* at ¶¶ 23-24.

[59] *See id.* at ¶ 38.

[60] *See id.* at ¶ 6.

[61] *See id.* at ¶ 6.

[62] *See* ITFS Allocation Order at ¶ 25, App. § 4.931. ITFS stations could also be used for incidental transmissions (e.g., training and administrative purposes). *See id*.

[63] *See id*. at ¶ 27. *See also* BRS/EBS NPRM at ¶ 107.

[64] *See* ITFS Reallocation Order at ¶¶ 114-18.

[65] *See id*. at ¶¶ 114-18.

[66] *See id.* at ¶ 118.

[67] *See* Amendment of Part 74 of the Commission's Rules and Regulations in Regard to the Instructional Television Fixed Service, Second Report and Order, FCC 85-294, 101 FCC 2d 49, ¶ 3 (Jun. 20, 1985) (ITFS Educational Use Order). *See also* First BRS/EBS Report and Order at ¶ 14.

[68] *See* ITFS Educational Use Order at ¶ 3.

[69] *See id*. at ¶¶ 90-97.

[70] *See* General Electric Co., Memorandum Opinion and Order, 61 Rad. Reg. 2d 143, ¶¶ 15-16 (Mass Media Bur., Sep. 22, 1986).

[71] *See* Amendment of Part 74 of the Commission's Rules Governing Use of the Frequencies in the Instructional Television Fixed Service, Report and Order, FCC 94-147, 9 FCC Rcd. 3360 (Jul. 6, 1994) (Channel Loading Order).

[72] *See* First BRS/EBS Report and Order at ¶ 12.

[73] *See id.* at ¶ 150.

[74] *See id.* at ¶ 156.

[75] *See id.* at ¶ 152.

[76] *See id.* at ¶ 156.

[77] *See id.* at ¶ 151.

[78] *See id.* at ¶ 158.

[79] An analyst recently reported that Sprint has demonstrated the ability to deliver 2.6 Gbps of capacity in a single sector using 120 MHz of spectrum in the 2.5 GHz band, but it does not appear that Sprint plans to deploy this capability. *See* Tammy Parker, *Sprint poised to become 'king of data speed,' report says*, Fierce Wireless (Mar. 16, 2014) (King of Data Speed), available at http://www.fiercewireless.com/tech/story/sprint-poised-become-king-data-speed-report-says/2014-03-16.

[80] *See* First BRS/EBS Report and Order at ¶ 312.

[81] *See* BRS/EBS NPRM at ¶¶ 60-82.

[82] *See* Letter from Angela Y. Kung to Marlene H. Dortch, FCC, IB Docket No. 12-343, Attachment (Mar. 26, 2013) (Clearwire Spectrum Letter).

[83] *See* News Release, Sprint, Sprint Demonstrates 1 Gigabit Over-the-Air Speed at Silicon Valley Lab (Oct. 30, 2013) (Sprint 1 Gbps Release), available at http://newsroom.sprint.com/news-releases/sprint-demonstrates-1-gigabit-over-the-air-speed-at-silicon-valley-lab.htm?previousArticle=11192&nextArticle=11190&gotoArt=%2Fnews-releases%2Fsprint-demonstrates-1-gigabit-over-the-air-speed-at-silicon-valley-lab.htm.

[84] Phil Goldstein, Sprint plans to use 2.5 GHz spectrum to catch up to Verizon, AT&T in LTE, FierceWireless (Aug. 29, 2013), available at http://www.fiercewireless.com/story/sprint-plans-use-25-ghz-spectrum-catch-verizon-att-lte/2013-08-29#ixzz2kTNMVhpV.

[85] *See* Sprint 1 Gbps Release.

[86] *See* King of Data Speed.

[87] *See, e.g.*, Reply Comments of Sprint Nextel Corp., WT Docket No. 12-269 at 19-28 (Jan. 7, 2013).

[88] *See* Sprint Nextel Corp. and Clearwire Corp., Memorandum Opinion and Order, FCC 08-259 at ¶ 71 (Nov. 7, 2008).

[89] See Steven Musil, Sprint sues Dish, Clearwire to prevent $6B takeover bid, CNET News (Jun. 17, 2013), available at http://news.cnet.com/8301-1035_3-57589736-94/sprint-sues-dish-clearwire-to-prevent-$6b-takeover-bid/.

[90] *See* Dr. Kostas Liopiros, Value and Utility of the U.S. 2.5 GHz Spectrum Band, Prepared for Sprint Nextel (Feb. 27, 2013) (Sprint Paper), http://newsroom.sprint.com/article_display.cfm?article_id=2528.

[91] *See id*. at 1, 8-12.

[92] *See* News Release, Sprint, Sprint and Clearwire Agree to Increased Acquisition Offer (Jun. 20, 2013), available at http://newsroom.sprint.com/news-releases/sprint-and-clearwire-agree-to-increased-acquisition-offer.htm. This MHz-pop price is more than DISH Network paid for its AWS-4 spectrum ($0.24/MHz-pop) in 2012, and AT&T paid for its WCS spectrum ($0.21/MHz-pop), also in 2012. *See* Sprint Paper at 23.

[93] *See* Sprint Paper at 1-2.

[94] *See id.* at 8.

[95] *See* Clearwire Spectrum Letter, Attachment.

[96] *See* Sprint Paper at 8, n. 13.

[97] *See id.*

[98] *See id.* at 2-3.

[99] *See id.* at 3-4.

[100] *See* WT Docket No. 03-66.

[101] *See* Petition to Deny of the Consortium for Public Education and the Roman Catholic Diocese of Erie, Pennsylvania, IB Docket No. 12-343 (Jan. 28, 2013) (Public Education Consortium Petition).

[102] *See id.* at 6-8.

[103] *See id.*

[104] *See id.* at 7.

[105] *See* Educational Broadband Service Long-Term De Facto Lease Agreement at § 5(c) (May 25, 2010), available at http://pinellasschool.iqm2.com/Citizens/SplitView.aspx?Mode=Video&MeetingID=1074&MinutesItemID=6911&MinutesID=1074&FileFormat=doc&Format=Minutes&MediaFileFormat=wmv.

[106] *See id.* at §§ 5(c), 7.

[107] *See id.* at Schedule 2(a).

[108] *See* Public Education Consortium Petition at 10.

[109] *See id.* at 10-11.

[110] *See* Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, 125 Stat. 156 (2012).

[111] *See* 47 U.S.C. § 309(j)(8)(G)(i).

[112] *See* 47 U.S.C. § 309(j)(8)(G)(ii). It would be appropriate to compensate EBS licensees for relinquishing their spectrum rights. There is some, albeit minimal, educational use of EBS spectrum, and some EBS licensees have invested in their own wireless facilities. To the extent EBS licensees primarily lease their spectrum, they have done so pursuant to FCC approval, and as a result, they have incurred transactions costs and incorporated their expected lease revenue into their budgets.

[113] Nationwide MHz-pops are calculated by multiplying the spectrum bandwidth in MHz (117.5 MHz for EBS) by the total U.S. population (308,745,538 according to the 2010 Census): 117.5 * 308,745,538 = 36,277,600,715. A MHz-pops price is calculated by dividing the total price paid for the spectrum by its MHz-pops. Conversely, the total price of the spectrum is calculated by multiplying its MHz-pops price (assuming $0.30 for 2.5 GHz spectrum) by its MHz-pops (36,277,600,715 in this example): $0.30 * 36,277,600,715 = $10,883,280,214.5.

[114] *See* Letter from Todd D. Gray, Counsel for National EBS Association, to Marlene H. Dortch, FCC, WT Docket No. 03-66 (Jun. 20, 2013).