



October 11, 2019

Scott Scheele, Esquire
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Antitrust Division, U.S. Department of Justice
450 Fifth Street, N.W., Suite 7000
Washington, D.C. 20530

Re: U.S., et al. v. Deutsche Telekom AG, et al., No. 1-19-cv-02232-TJK, Tunney Act Comments of Voqal

Dear Mr. Scheele:

Voqal¹ respectfully submits these comments, pursuant to the Antitrust Policy and Procedures Act, 15 U.S.C. 16(b)-(h), to seek divestiture of a portion of the 2.5 GHz band spectrum currently controlled by Sprint to ensure effective competition in the development of 5G networks. 5G network deployment is a key goal of the Antitrust Division of the U.S. Department of Justice (“Antitrust Division”) and the Federal Communications Commission (“FCC”) in approving the proposed transaction. Voqal and other Educational Broadband Service (EBS) providers use 2.5 GHz band spectrum to provide educational telecommunications services, primarily wireless internet service to nonprofit organizations and educational institutions. EBS licensees, through leasing agreements, are the source of most of Sprint’s 2.5 GHz mid-band spectrum. Exhibit 1 is my declaration to the Federal Communications Commission that sets out a detailed history of the 2.5 GHz band spectrum.

If allowed, the proposed transaction will produce significant harms to competition, consumers, and EBS spectrum licensees, such as Voqal. The only meaningful solution to these harms is divestiture of a portion of the 2.5 GHz band spectrum currently held by Sprint. Divestiture of a portion of the 2.5 GHz band spectrum will enable more substantial development of cost-effective 5G, allowing at least one other competitor to build out a robust nationwide 5G network for consumers. At the same time, divestiture of some 2.5 GHz spectrum will not harm the merging parties, as New T-Mobile stands to raise significant revenue from the sale of such assets that will help it achieve its 5G aspirations, a significant benefit to competition and consumers.

¹ Voqal is the collective trade name for five nonprofit organizations that hold licenses in the Educational Broadband Service (EBS): Chicago Instructional Technology Foundation (CITF), Denver Area Educational Telecommunications Consortium (DAETC), Instructional Telecommunications Foundation (ITF), Portland Regional Educational Telecommunications Corporation (PRETC), and Twin Cities Schools’ Telecommunications Group (TCSTG), all of which hold at least one EBS license. The Voqal entities are lessors to Sprint, and potentially sellers, of spectrum in the 2.5 GHz band, a market that will suffer anticompetitive harm as a result of the proposed transaction, as explained in more detail herein.



I. Introduction

A. Voqal Holds 2.5 GHz Band Spectrum Licenses and Provides Schools and Low-Income Households with Affordable Mobile Internet Services.

Voqal has been serving educators and communities for over 30 years. Voqal originally served educators by transmitting educational video programming to K-12 schools and wireless cable customers. After the FCC allowed the band to transition from instructional television service to broadband data service, Voqal entered into lease agreements with Clearwire that provided meaningful educational benefits, as described below. Sprint later bought Clearwire in 2013.²

Voqal's most prominent project, Mobile Citizen, is a wireless internet service for educational institutions, nonprofit organizations, and social welfare agencies. As it operates today, Mobile Citizen is made possible because of a series of interrelated excess capacity agreements between EBS licensees Voqal and North American Catholic Educational Programming Foundation (NACEPF), on the one hand, and Clearwire Corporation (then a major holder of 2.5 GHz spectrum), and one of its subsidiaries, on the other.³

As of April 2019, Mobile Citizen provided subsidized service to 391 organizations. Its services have found widespread adoption among nonprofits whose chief purpose is to reduce the digital divide and homework gap. Mobile Citizen is also used by educational institutions both on campus to provide connectivity, as well as off-site through student and teacher device check-out programs. As of April 2019, Mobile Citizen has donated 968 free accounts to 77 schools at an estimated annual value of \$580,000 and has subsidized 24,314 accounts worth an estimated \$11.6 million per year.⁴ Through nonprofit partners, Mobile Citizen serves thousands of low-income households that commercial providers have largely ignored. One partnership, in particular, serves families who earn up to 200% of the poverty level.⁵ This work is truly making an impact on the digital divide and the homework gap – two of the FCC's top priorities. Mobile Citizen has achieved all this without ever taking a penny from any Universal Service Fund or other subsidy programs.

² "Sprint to Acquire 100 Percent Ownership of Clearwire for \$2.97 per Share." Sprint Newsroom. December 17, 2012. Available online: <https://sprint.co/2p9meG3>.

³ Pursuant to the Clearwire Agreements, Voqal and NACEPF receive what are referred to as Cost-Free Educational Accounts (CFEAs), which they may give away or resell to educational institutions, nonprofit organizations, and social welfare agencies. CFEAs are broadband accounts that allow access to the Sprint mobile broadband services platform. Voqal provides these CFEAs to educational entities and nonprofits via our Mobile Citizen project for free or at very favorable rates.

⁴ The estimated annual dollar value is calculated by multiplying the number of accounts that Mobile Citizen provides for free by \$600 and the number of subsidized accounts by \$480.

⁵ PCs for People. Available Online: <https://www.pcsforpeople.org/>.



In addition to Mobile Citizen, Voqal has addressed the root causes of educational inequity by reinvesting spectrum lease royalties back into the communities it serves. One notable example is Voqal's Education Opportunity Project,⁶ which has invested over \$1.8 million in innovative startup companies tackling some of the most overlooked areas of education. Examples include investments in companies that build tools and curricula to improve personalized learning, connect businesses and classrooms to improve practical skills training, and address social-emotional learning.

B. Voqal Has a Compelling Interest in the 2.5 GHz Band Spectrum and Has Actively Assisted the Antitrust Division and Federal Communications Commission in the Proposed Transaction.

Voqal has presented the evidence in this comment to the Antitrust Division and the FCC in full detail.⁷ Voqal has met with staff and provided detailed information on the importance of 2.5 GHz spectrum to the deployment of cost-effective 5G networks. Despite this extensive and compelling information, the Antitrust Division did not even mention the competitive significance of 2.5 GHz spectrum in the development and deployment of 5G networks in its complaint, final judgment, or competitive impact statement, although it does discuss a small spectrum divestiture of Sprint's 800 MHz spectrum to DISH to assist in building its new network.⁸

II. Argument and Analysis

Voqal will address three primary reasons why the proposed transaction should be denied absent a divestiture of a significant amount of 2.5 GHz band spectrum. First, New T-Mobile will possess impermissible buyer market power in the 2.5 GHz band that will harm competition in the buildout of cost-effective 5G networks. Second, New T-Mobile's buyer market power will cause harm to consumers by limiting their choices in 5G networks. Third, New T-Mobile's buyer market power will cause harm to current EBS license holders. In addition, Voqal believes that the Department of Justice's remedy to divest assets to DISH Network is an extremely weak substitute for Sprint in the wireless market and is destined to fail. Voqal understands that other commenters will provide substantive evidence documenting how DISH Network is not a reasonable substitute for Sprint in the wireless marketplace without other structural remedies, such as divestiture of 2.5 GHz band spectrum.

⁶ A select list of educational investments made by Voqal can be found at <https://voqal.org/our-work/investing-for-educational-impact/>.

⁷ Voqal leadership met with the Antitrust Division staff and several state attorneys general staff on two occasions, the most recent of which was March 26, 2019. Voqal also shared a memo with the Antitrust Division on June 16, 2019. Voqal has also presented filings, including declarations, to the FCC, including its divestiture proposal. See "2.5 GHz Spectrum Divestiture as a Condition for Approving the Sprint/T-Mobile Merger." *Ex Parte* Presentation of Voqal to Federal Communications Commission. March 4, 2019. Available online: <https://bit.ly/2nFQZSi>.

⁸ Competitive Impact Statement. *United States of America, et al. v. Deutsche Telekom AG, et al.* Civil Action No. 1:19-cv-02232-TJK. Filed June 30, 2019. Available online: <https://www.justice.gov/opa/press-release/file/1189336/download>.



A. If the Transaction Is Approved by the Court, New T-Mobile Will Possess Impermissible Buyer Market Power in the 2.5 GHz Spectrum Band That Will Harm Competition In the Buildout of Cost-Effective 5G Networks.

In its press release announcing the settlement, the Antitrust Division highlighted the “expedite[d] deployment of high-quality 5G for American consumers”⁹ as a major benefit of the proposed settlement. As early as May, a majority of FCC commissioners also released statements supporting the merger even before a divestiture was required by the Antitrust Division. For example, Commissioner Brendan Carr released a statement saying “I support the combination of T-Mobile and Sprint because Americans across the country will see more competition and an accelerated buildout of fast, 5G services.”¹⁰ The parties argued aggressively that the transaction would speed the deployment of 5G to the benefit of consumers. While this is a worthy aspiration, a careful analysis of the spectrum requirements to develop cost-effective 5G networks suggests that neither the Antitrust Division nor the FCC has given serious consideration to providing the consumer with multiple efficient and cost-effective 5G networks.

1. 5G Networks Require Blocks of Three Frequency Bands.

Effective 5G networks require large contiguous blocks of three different types of frequencies: low-band, high-band (also called millimeter wave), and mid-band spectrum.

- Low-band spectrum travels longer distances and penetrates walls. Low-band spectrum is necessary to provide wider coverage at a more affordable cost. In the current market, all four national wireless carriers control at least some low-band spectrum. As a condition of approving the merger, the proposed decree provides for the divestiture of approximately 13.5 MHz of Sprint’s 800 MHz spectrum to DISH Network.
- High-band spectrum is useful for providing high capacity networks in dense urban areas. High-band spectrum is usually available in larger contiguous blocks, which provides significant capacity using 5G technology; however, these frequencies are inferior to low- and mid-band spectrum in terms of coverage because they travel significantly shorter distances and do not penetrate walls. In other words, widespread signal coverage via high-band spectrum requires hundreds of thousands of additional cell sites and will not be economical to deploy widely. AT&T, T-Mobile, and Verizon already control this type of spectrum. DISH Network and Sprint do not possess a significant quantity of high-band spectrum. However, both incumbent wireless providers and new entrants have an opportunity to obtain high-band millimeter wave

⁹ “Justice Department Settles with T-Mobile and Sprint in Their Proposed Merger by Requiring a Package of Divestitures to Dish.” Department of Justice Office of Public Affairs. July 26, 2019. Available online: <https://bit.ly/2YrSzlf>.

¹⁰ “Carr Announces Support for T-Mobile-Sprint Transaction.” Federal Communications Commission Office of Brendan Carr. May 20, 2019. Available online: <https://docs.fcc.gov/public/attachments/DOC-357536A1.pdf>.



spectrum at auctions this year, as the FCC plans to auction off the 37 GHz, 39 GHz, and 47 GHz bands in December 2019.¹¹

- Mid-band spectrum offers the critical combination of coverage and capacity currently coveted by wireless providers. Mid-band spectrum is often called the “Goldilocks” spectrum because it provides just the right combination of these two characteristics. Mid-band spectrum can penetrate walls, meaning 5G networks built on this spectrum will work indoors, unlike high-band spectrum which is an outdoor-only phenomenon. This makes mid-band ideal for cost-effective 5G buildout. Crucially, the 2.5 GHz band is the single largest band of contiguous mid-band spectrum today.¹² Only Sprint controls the vast quantity of contiguous mid-band spectrum necessary for 5G.

2. Sprint’s 2.5 GHz Spectrum Is the Primary Asset It Brings to the Proposed Transaction.

Access to Sprint’s large holding of 2.5 GHz spectrum is the primary asset in the T-Mobile/Sprint transaction for 5G. As described above, the 2.5 GHz band has distinct technological advantages over other frequency bands that are available for 5G deployment.¹³ T-Mobile is currently relying on a low band 600 MHz spectrum for its 5G launch, which is insufficient for high-speed connectivity.¹⁴ Sprint’s 2.5 GHz spectrum holdings are unmatched by any carrier. Because of a series of acquisitions of wireless operators and lease agreements over the years, Sprint has acquired a dominant position in almost all U.S. markets, holding an average of more than 160 MHz of a possible 194 MHz of 2.5 GHz spectrum in the top 100 U.S. markets. Of even greater significance, Sprint controls all 194 MHz of 2.5 GHz spectrum in such major Cellular Market Areas (CMAs, a unit of geography) as Chicago, Washington D.C., Pittsburgh, Miami, Baltimore, Minneapolis-St. Paul, Denver, and Phoenix. If the transaction is approved in its current form, T-Mobile will control all of Sprint’s 2.5 GHz spectrum. This is an enormous competitive advantage, leaving only New T-Mobile able to deploy 5G cost efficiently.

Although network capacity is lower at 2.5 GHz than at millimeter wave technology used by AT&T and Verizon for 5G, Sprint’s range and penetration are far superior.¹⁵ Sprint, which

¹¹ “Public Notice: Incentive Auction of Upper Microwave Flexible Use Service Licenses in the Upper 37 GHz, 39 GHz, and 47 GHz Bands for Next-Generation Wireless Services.” Federal Communications Commission. July 11, 2019. Available online: <https://bit.ly/2nPhpkY>.

¹² “A Giant Leap for 5G.” FCC Chairman Ajit Pai. FCC Blog. June 18, 2019. Available online: <https://www.fcc.gov/news-events/blog/2019/06/18/giant-leap-5g>.

¹³ For greater detail on why the 2.5 GHz band is unique and has technological advantages, see Voqal’s Petition to Deny, Section II. Filed August 27, 2018. Available online: <https://bit.ly/2MB5kez>.

¹⁴ “Verizon: 5G speeds on low-spectrum bands will be more like ‘good 4G.’” Jon Brodtkin. *ArsTechnica*. August 8, 2019. Available online: <https://bit.ly/33yhTvY>.

¹⁵ As examples, the range of millimeter wave technology is very short (200 meters) requiring an immense investment in radios and cell towers. The millimeter waves also have great difficulty penetrating exterior walls.



claims to be financially incapable of competing without the merger,¹⁶ has deployed 5G using only 40-60 MHz of its 2.5 GHz spectrum. Its current buildout is available “in areas of Atlanta, Chicago, Dallas-Fort Worth, Houston, Kansas City, Los Angeles, New York City, Phoenix, and Washington, D.C., covering approximately 2,100 square miles and 11 million in population total across all nine market areas.”¹⁷ According to press reports, Sprint Chief Technology Officer Dr. John Saw said the company is seeing download speeds of 328 Mbps, even as it uses only a portion of its 2.5 GHz holdings for 5G.¹⁸

Sprint’s 2.5 GHz spectrum advantage has led some observers to conclude that it is winning the “Race to 5G.”¹⁹ The fact that Sprint is able to provide 5G service with just 40-60 MHz²⁰ of the 2.5 GHz spectrum establishes that T-Mobile and Sprint do not need all 160 MHz in the top 100 U.S. markets to deploy a cost-effective 5G network. Divestiture of a part of this spectrum to a competitor – spectrum T-Mobile does not need for its 5G network – would enhance competition substantially.

3. There Are No Current or Soon Forthcoming Sources of Mid-Band Spectrum for 5G.

Today, the 2.5 GHz spectrum band is the single largest contiguous block of mid-band spectrum that has been licensed for mobile services. In fact, it is now impossible to acquire mid-band spectrum in the large, contiguous blocks best suited for 5G outside of the 2.5 GHz band. The 2.5 GHz band’s contiguity is far superior than any other comparable available bands, such as the 1.7 GHz, the 1.9 GHz, and the 2.1 GHz bands. Multiple carriers control licenses in each of those bands; therefore, contiguous channel widths are severely limited relative to the 2.5 GHz band. In the 2.5 GHz band, only one major carrier, Sprint, controls the vast majority of licenses, typically in large contiguous blocks.

Given the intense demand for mid-band spectrum, the FCC is now considering making available other mid-band options, including the 3.5 GHz band, also known as the Citizens Broadband Radio Service (CBRS), and the 3.7 to 4.2 GHz band, also known as the C-Band;

¹⁶ Sprint *Ex Parte* Filing, April 15, 2019. Available online: <https://bit.ly/2KLR2ar>.

¹⁷ “Sprint Lights Up True Mobile 5G in Los Angeles, New York City, Phoenix and Washington, D.C.” Sprint Press Release. August 27, 2019. Available online : <https://newsroom.sprint.com/about-us/network-news/>.

¹⁸ “Sprint CTO: Chicago 5G Launch Highlights Sprint 5G Advantages of Broad Coverage, Split 5G/LTE Mode Technology.” Joan Engebretson. *Telecompetitor*. July 11, 2019. Available online: <https://bit.ly/2oAG1xG>.

¹⁹ “Race to 5G: Sprint Now Leads in US 5G coverage.” Sascha Segan. *PCMag*. September 4, 2019. Available online: <https://www.pcmag.com/news/370548/race-to-5g-september-update>.

²⁰ “Sprint turns on ‘true’ mobile 5G with Massive MIMO and ENDC.” *FierceWireless*. May 30, 2019. Available online: <https://bit.ly/2VZsPgV>.



however, these other bands are not functional substitutes to 2.5 GHz spectrum. In fact, Sprint and T-Mobile have made the claim in their own FCC filing that “these bands are not practical substitutes for the spectrum resources involved in the transaction and cannot be relied upon for standalone development of a robust 5G network.”²¹ Exhibit 2 includes an excerpt from T-Mobile and Sprint’s Joint Opposition to the FCC²² in which the merging parties vehemently dismiss other mid-band alternatives as a substitute for 2.5 GHz, including an entire section with the heading “There Are No Viable Alternatives for T-Mobile and Sprint to Provide a Comparably Robust, Nationwide 5G Network in the Same Timeframe.”²³ The carriers also make the claim that “If the Commission wants a cutting-edge, nationwide, robust 5G mobile network deployed in the United States before in other countries, it should not rely on the speculative availability of other mid-band spectrum.”²⁴

In short, both the CBRS band and the C-Band present a host of challenges for any wireless provider, including significant power restrictions, sharing requirements, inferior propagation relative to 2.5 GHz, lack of equipment ecosystems, technological limitations, multi-year transition periods to make the spectrum available, and a series of other significant challenges.²⁵ Because these other mid-band options are currently not available and present challenges, the only way to ensure a competitive marketplace in the development of 5G is to require the divestiture of some 2.5 GHz spectrum to another carrier as a merger condition.

4. New T-Mobile Will Control Spectrum Holdings Sufficient to Impede Competition.

The FCC and the Antitrust Division have long recognized that spectrum is an essential input for providing wireless service.²⁶ In its *19th Mobile Wireless Competition Report*, the FCC found that “spectrum is a critical input in the provision of mobile wireless services and affects if and when the existing service providers and potential entrants will be able to expand capacity or deploy networks.”²⁷

Like other markets, anticompetitive aggregation of a critical input can harm competition and consumers alike. For nearly 40 years, the FCC has implemented policies that prevent

²¹ Joint Opposition of T-Mobile US, Inc. and Sprint Corporation. FCC WT Docket No. 18-197. Filed September 17, 2018. Page 55. Available online: <https://bit.ly/2IzAC16>.

²² *Id.* at pages 53-39.

²³ *Id.*

²⁴ *Id.* at page 58.

²⁵ *Id.* at page 57.

²⁶ Policies Regarding Mobile Spectrum Holdings, *Report and Order*, 29 FCC Rcd. 6133, 6144 ¶ 17 (June 2014) (“*Mobile Spectrum Holdings Report and Order*”).

²⁷ See *19th Wireless Competition Report*, 31 FCC Rcd. at 10572 ¶ 49.



anticompetitive spectrum aggregation by placing limits on how much spectrum can be purchased at auction and via secondary market transactions.²⁸ In 2014, the FCC adopted the *Mobile Spectrum Holdings Report and Order*, establishing a formal policy to codify spectrum aggregation limits. These limits are referred to as the “spectrum screen.”²⁹ In the *Mobile Spectrum Holdings Report and Order*, the FCC concluded that “for there to be robust competition, multiple competing service providers must have access to or hold sufficient spectrum to be able to enter a marketplace or expand output rapidly in response to any price increase or reduction in quality, or other change that would harm consumer welfare.”³⁰

In general, the FCC established rules that require it to “apply the spectrum screen on a county-by-county basis to identify those CMAs where an entity would hold approximately one-third or more of the total spectrum that is suitable and available for the provision of mobile telephony/broadband services post-transaction.”³¹ If the merging companies surpass the one-third threshold, there it is indicative of a potential competitive harm. In its *Mobile Spectrum Holdings Report and Order*, the FCC voted to add several spectrum bands to the spectrum screen analysis, including 2.5 GHz spectrum.³²

If approved, this transaction would leave New T-Mobile with an anticompetitive concentration of spectrum – including the only large, contiguous chunk of mid-band spectrum available in the market today. In its original Petition to Deny, DISH pointed out that “Sprint already holds the most spectrum of all carriers in a number of counties and is the only carrier to hold more than 240 MHz in any county.”³³ It went on to explain that:

“New T-Mobile would be over the screen threshold in 1,996 out of the nation’s 3,221 counties, or in 532 CMAs, covering all of the top 100 markets. By comparison, the rejected AT&T/T-Mobile merger would have caused AT&T to exceed the screen in 274 CMAs. New T-Mobile would be over the screen across 90.2% of the country’s population and almost half of its land area.”

Even with the modest divestiture of approximately 13.5 MHz of Sprint’s 800 MHz spectrum to DISH, New T-Mobile still far exceeds the one-third threshold and deserves stricter scrutiny. The FCC has yet to provide its rationale for why, after nearly 40 years of preventing any entity from aggregating the most precious resource for the provision of wireless service, it

²⁸ See *Mobile Spectrum Holdings Report and Order*, “Section B. History of Spectrum Aggregation Limits.”

²⁹ Voqal understands that the “spectrum screen” is a competitive measure created by the FCC, but its significance as a measure of concentration is equally valuable to the Antitrust Division’s competitive evaluation.

³⁰ *Mobile Spectrum Holdings Report and Order* at ¶ 17.

³¹ *Id.* at ¶ 18.

³² *Id.* at ¶ 118 (“We will update the spectrum screen to increase the amount of 2.5 GHz spectrum.”)

³³ DISH Petition to Deny. August 27, 2018.



will now simply ignore the limits and approve the merger. Even if the FCC finds that such aggregation is in the public interest, the Antitrust Division is required to assess whether such aggregation is anticompetitive or not. The Antitrust Division neither considered nor offered any rationale as to why this unhealthy spectrum aggregation should be allowed. As Voqal herein demonstrates, the only way to ameliorate this competitive harm from spectrum aggregation is to require the divestiture of a portion of the 2.5 GHz band spectrum.

5. The Best Evidence of the Importance of 2.5 GHz Spectrum Is the Testimony of the Sprint and T-Mobile Executives.

As with any merger case the Antitrust Division initiates, the best evidence of the true state of the market comes from the filings and presentations of senior management of the merging parties. Company executives have repeatedly attested to the value of 2.5 GHz spectrum in public comments. Sprint's Chief Strategy Officer, Kevin Crull explained that "Sprint has a treasure trove of 2.5 GHz spectrum and this is particularly good for 5G because it sits in perfect balance of speed and capacity and propagation, or distance and coverage."³⁴ T-Mobile CEO John Legere dismissed Verizon's millimeter wave strategy, arguing that Verizon's 5G "strategy will not work. It is fake." With such limitations as a range of only 200 meters and the great difficulty of penetrating exterior walls, Legere estimated the Verizon's 5G network "would cost \$1.5 trillion to do."³⁵ Sprint CEO Michel Combes commented in 2018: "[i]f you want to do coverage, a national coverage with millimeter wave [sic] you will need one million sites." Mr. Combes concluded: "Let's be clear once again and let's be fact based on this one. Mid-band spectrum is the sweet spot for 5G mobile."³⁶ T-Mobile CTO Neville Ray set out the "severe limitations" of millimeter wave technology of Verizon: "Millimeter wave (mmWave) spectrum has great potential in terms of speed and capacity, but it doesn't travel far from the cell site and doesn't penetrate materials at all. It will never materially scale beyond small pockets of 5G hotspots in dense urban environments."³⁷ He concluded that "Sprint has the critical middle layer of 2.5 GHz mid-band spectrum, which provides the balance of coverage and capacity that enables a seamless and meaningful 5G experience. Mid-band spectrum is key to providing an ideal mix of coverage and capacity for 5G networks."³⁸

³⁴ Kevin Crull, Chief Strategy Officer, Sprint Corporation. Transcript of Remarks at 5G North America. July 5, 2018.

³⁵ John Legere, Chief Executive Office, T-Mobile US, Inc. Transcript of Remarks on Q2 2019 Earnings Call. (Jul. 29, 2019) "People have said that we trash mmWave as an alternative for 5G, and that's absolutely not true. We have made fun of a mmWave-only strategy. It will not work. Verizon's strategy will not work. It's fake. It was a first mover play. It would cost \$1.5 trillion to do, and they're kind of dead in the water without a strategy right now. I think the world's starting to catch on." Available online: <https://bit.ly/2m38U4o>.

³⁶ Michel Combes, CEO, Sprint Corporation. Transcript of Remarks at J.P. Morgan Global Technology, Media and Communications Conference. May 6, 2018.

³⁷ "The 5G Status Quo is Clearly Not Good Enough." Neville Ray, Chief Technology Office, T-Mobile US, Inc. April 22, 2019. Available online: <https://www.t-mobile.com/news/the-5g-status-quo-is-clearly-not-good-enough>.



The Sprint and T-Mobile executives have explained the consequences of the concentration of mid-band spectrum in their hands. Verizon and AT&T do not have it – and will not for the foreseeable future. Their 5G networks will be enormously expensive to build, which will produce higher consumer prices. The newly created DISH Network has neither the capacity nor the financial means to deploy a cost-effective 5G network, despite the relatively minor low-band spectrum assets DISH would obtain under the Proposed Final Judgment. Without a divestiture of 2.5 GHz spectrum, there can be only one efficient and cost-effective 5G network in the United States in coming years.

B. If the Transaction Is Approved by the Court, New T-Mobile’s Buyer Market Power in the 2.5 GHz Band Will Harm Consumers.

While the evidence establishes that competition will be harmed if the Court allows New T-Mobile to maintain its domination over the 2.5 GHz band, individual consumers will also be directly harmed. Consumers will have access to only one capable 5G network for years to come. No competitor will have the large, contiguous block of mid-band spectrum necessary to build a cost-effective 5G network in the United States. As a result, consumers will be limited in their wireless networks.

One of the promises of 5G is new services, applications, and innovation. Not only will consumers only have access to a single 5G wireless network, but they also will be limited from accessing these new applications if they are customers of any wireless carrier other than New T-Mobile. Consumer choice is a central reason for the court to require a divestiture of 2.5 GHz spectrum.

C. If the Transaction Is Approved by the Court, New T-Mobile’s Buyer Market Power in the 2.5 GHz Band Will Harm Educational and Nonprofit EBS Licensees.

Voqal and other educational and nonprofit EBS licensees will be seriously harmed in their mission if New T-Mobile’s buyer market power in this band is not restrained. There are two primary harms created by the proposed transaction: anticompetitive market harms and practical harms. The anticompetitive market harms created by the merger are classic antitrust restraints. As Voqal previously pointed out in its Petition to Deny to the FCC, Sprint currently holds an overwhelming spectrum position in the 2.5 GHz band — vastly more than any other wireless provider. And there is evidence that Sprint enjoys and exploits buyer power over sellers and lessors of 2.5 GHz spectrum.³⁹ The proposed transaction would exacerbate these anticompetitive market conditions in three ways: it would amplify the economic incentives for New T-Mobile to

³⁸ *Id.*

³⁹ Petition to Deny the Above-Captioned Applications As Currently Proposed. Voqal. FCC WT Docket No. 18-197. August 27, 2018. Available online: <https://bit.ly/2MB5kez>.



exercise its buyer power, augment New T-Mobile's financial capacity to acquire even more 2.5 GHz spectrum, and combine T-Mobile's 600 MHz advantages with Sprint's control of the 2.5 GHz band. The result will be that New T-Mobile will impose below-competitive prices on sellers and lessors of 2.5 GHz spectrum, many of which are nonprofit educational entities.

In addition to market harms, there are practical harms that have yet to be addressed by Sprint and T-Mobile. Specifically, New T-Mobile has made no commitment to existing EBS licensees who stand to suffer service interruption or other harms as a result of the proposed transaction. To gain access to EBS spectrum, Sprint (and Clearwire before Sprint's purchase of the company) signed lease agreements with EBS licensees that included free service to comply with the FCC's educational use requirement.⁴⁰ As a result, a significant number of EBS licensees offer service to students, faculty, or others via Sprint wireless data hotspots. That is how Voqal's Mobile Citizen offers service to tens of thousands of end users today.

This EBS-based internet access is threatened by the proposed transaction. In its Description of Transaction, Public Interest Statement, and Related Demonstrations, T-Mobile and Sprint describe that "Sprint customers' 2.5 GHz LTE traffic will move to T-Mobile's AWS spectrum, which could not occur but for this transaction." This means that most or all of the wireless devices used for EBS educational service will not work after this transition because they do not receive LTE transmissions in the new band. Educational users will thus suffer harm. This is not the first time a wireless carrier has failed to transition EBS educational users. Before November 2015, Sprint had deployed a technology called WiMAX on the 2.5 GHz band. Educational licensees, including Voqal, had deployed a significant number of WiMAX devices to end users. In November 2015, Sprint planned to shutter its WiMAX network to transfer users to LTE technology. Educational licensees, including Voqal, petitioned a court to block the transition temporarily. The court enjoined Sprint from shutting down WiMAX before it accommodated educational users.⁴¹ The same transition scenario is due to repeat itself if there is no remedy offered. The hundreds of thousands of end users relying on Sprint's 4G LTE offered over the 2.5 GHz band will have devices that no longer work on the network if New T-Mobile is simply allowed to ignore the needs of EBS licensees.

⁴⁰ See 47 CFR § 27.1201 - EBS eligibility. Currently, EBS licenses in the 2.5 GHz band can only be held by "an accredited institution or to a governmental organization engaged in the formal education of enrolled students or to a nonprofit organization whose purposes are educational." In addition to this eligibility restriction, the FCC requires that licensees reserve 5% of the capacity of its channels to offer educational service.⁴⁰ Note: In July the FCC voted to eliminate these eligibility and educational service rules. Despite this regulatory change, EBS licensees serve a large user base that is at risk of losing service.

⁴¹ *North American Catholic Educational programming Foundation, Inc., Chicago Instructional Technology Foundation, Inc., Denver Area Educational Telecommunications Consortium, Inc., Instructional telecommunications Foundation, Inc., Portland Regional Educational Telecommunications Corporations and Twin Cities Schools' Telecommunication Group, Inc. v. Clearwire Spectrum Holdings II LLC, Clearwire Legacy LLC, f/k/a/ Clearwire Corporations and Sprint Spectrum L.P.* November 4, 2015. Decision available online: <https://bit.ly/33c7Ziq>.



III. Proposed Divestiture Remedy

In light of the importance of the transfer of this massive quantity of 2.5 GHz spectrum from Sprint to T-Mobile, divestiture is essential to foster procompetitive 5G network deployment in the United States. This is a key goal articulated by both the Antitrust Division and the FCC in this proceeding.

A. “Top Half” Divestiture of 2.5 GHz Spectrum is the Only Meaningful Solution to Address Harm to Competition, Consumers and EBS Licensees.

Voqal advocates what it calls “Top Half” 2.5 GHz spectrum divestiture. This “Top Half” divestiture would consist primarily of commercial Broadband Radio Service (BRS) licenses and the G channel group of Educational Broadband Service (EBS) leases Sprint currently controls. Voqal has provided its specific divestiture proposal to the Transaction Team at the FCC and antitrust enforcers, both federal and state. Appendix A of Exhibit 3 contains a diagram of the current 2.5 GHz band plan and the allocations for BRS and EBS. By way of background, BRS is a 2.5 GHz commercial service that is licensed throughout the United States. According to the FCC’s Universal Licensing System, Sprint currently holds BRS licenses in 454 out of 487 geographic units known as Basic Trading Areas in the United States, including each and every major market – clearly a dominant position. EBS is an educational service that is currently licensed in about 50% of the U.S. geography containing about 85% of the U.S. population. Currently, only educational and nonprofit entities can hold EBS licenses; however, the FCC allows EBS entities to lease their spectrum. There are roughly 1300 EBS licensees holding over 2190 EBS licenses. Sprint has aggregated as many as 1600 EBS leases and is the dominant player in the EBS portion of the band. Roughly 80% of EBS licenses are for spectrum in the bottom half of the EBS band.

Voqal’s recommended divestiture proposal divides the 194 MHz of the 2.5 GHz band into the Bottom Half of 100 MHz, which runs from 2496 MHz through 2596 MHz, and the Top Half of 94 MHz, which runs from 2596 MHz through 2690 MHz. Under the Top Half proposal, New T-Mobile would be required to divest all commercial BRS licenses and lease agreements as well as the G Channel Group EBS leases. In total, this would provide another wireless competitor with up to 94 MHz of critical mid-band spectrum for 5G buildout nearly nationwide. By way of comparison, today, Sprint now uses 60 MHz of this 2.5 GHz spectrum for its 5G network.⁴² As a result, it offers speeds at 300 Mbps that provides wide geographic coverage where Sprint has deployed 5G.⁴³

⁴² “Sprint CTO: Chicago 5G Launch Highlights Sprint 5G Advantages of Broad Coverage, Split 5G/LTE Mode Technology.” Joan Engebretson. *Telecompetitor*. July 11, 2019. Available online: <https://bit.ly/2oAG1xG> (“In Chicago, Sprint has deployed LTE and 5G in the 2.5 GHz band, devoting 60 MHz of spectrum to each technology. The company is seeing average 5G download speeds of 328 Mbps, although peak speeds can exceed 800 Mbps, he said.”)

⁴³ *Id.*



Top Half Divestiture is easier to implement relative to Bottom Half Divestiture. Under Top Half, New T-Mobile would merely sell off its BRS licenses and lease agreements for one of the five EBS channel groups. Alternatively, Bottom Half Divestiture would require the sale of the EBS channel groups A, B, C, and D. Often four separate license holders control those channel groups in each market. As a result, bottom half transaction costs would be much higher.

B. Top Half Divestiture of 2.5 GHz Spectrum is the Only Meaningful Solution to Accelerate 5G Competition in the United States.

1. Top Half Divestiture Would Fuel Competition in 5G Network Deployment.

The 2.5 GHz band is already licensed for mobile broadband use and is being used for Sprint's 5G network today. Network equipment and handsets are affordable and available off the shelf today. And as was noted, 2.5 GHz spectrum propagates farther than millimeter wave frequencies and also penetrates walls, meaning it requires fewer cell sites to deploy, producing significant cost savings. Divestiture would immediately fuel 5G competition and benefit consumers by allowing for not one but at least two 5G networks to operate in the 2.5 GHz band. Without divestiture, competitors will be waiting at least two to five years for inferior mid-band spectrum options to become available.

2. Top Half Divestiture Would Create Additional Competition for 2.5 GHz Spectrum, Which Would Benefit EBS Licensees and Their End Users – Primarily Students, Schools, Nonprofits, and Low-Income Individuals.

When firms compete for EBS, lease terms are much more favorable. When Sprint became the dominant lessee of EBS, prices for leases suffered. Without divestiture, EBS licensees will be forever harmed by New T-Mobile's buyer market power status. This is a classic case of monopsony that only a divestiture requirement can address.

C. Divestiture of 2.5 GHz Spectrum Will Not Prevent the Merging Parties from Offering 5G

Top Half Divestiture of the 2.5 GHz spectrum will not hamper New T-Mobile from delivering 5G to consumers. To the contrary, it will ultimately provide significantly more revenue for New T-Mobile to do more. New T-Mobile simply does not need the full arsenal of 2.5 GHz band to provide the technological benefits it promised the Antitrust Division and FCC. Sprint's current 5G deployment utilizes just 60 MHz of 2.5 GHz spectrum,⁴⁴ but still reaches download speeds that are 6 times greater than its 4G LTE network.⁴⁵ After divestiture, New T-

⁴⁴ *Id.*

⁴⁵ "Sprint Lights Up True Mobile 5G in Los Angeles, New York City, Phoenix, and Washington, D.C." Sprint Press Release. August 27, 2019. Available online: <https://sprint.co/30D7z3J>.



Mobile would still have the ability to control as much as 100 MHz of contiguous 2.5 GHz spectrum, an amount that far exceeds any other competitor. T-Mobile will also have an option of bidding on additional 2.5 GHz spectrum next year, as the FCC plans to conduct a public auction of unassigned EBS licenses – primarily in rural areas – sometime before September 30, 2020.⁴⁶ New T-Mobile's desire to retain all of Sprint's spectrum is anti-competitive on its face and the Court must act to prevent the adverse outcome of its dominance of this essential spectrum band.

An added benefit of this divestiture is that it would provide New T-Mobile with substantial additional capital to deploy its 5G network. Some estimates show the entire 2.5 GHz band could be worth as much as \$31.7 billion⁴⁷ in a functioning market. It is well understood that multiple wireless carriers are desperate for mid-band spectrum. By selling 94 MHz of the 2.5 GHz band as required by this proposed divestiture, New T-Mobile could receive payments of between \$10 billion and \$20 billion for this prime mid-band spectrum. This new infusion of capital would help New T-Mobile quickly deploy 5G. Meanwhile, another competitor – including possibly DISH – would also have access to a large contiguous block of mid-band spectrum necessary to provide 5G. This is truly a win-win that provides a highly competitive market, thus eliminating harm to competition, consumers, and educational spectrum licensees.

IV. Conclusion

For the foregoing reasons, Voqal respectfully urges the Antitrust Division to amend its Final Judgment to require the proposed divestiture of Sprint's 2.5 GHz spectrum. This will enhance competition in the developing 5G market, as well as continuing to make available educational broadband services for those in need.

Respectfully submitted,

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⁴⁶ "Estimate of Systems of Competitive Bidding for Fiscal Year 2020." Public Notice from Federal Communications Commission. September 30, 2019. Available online: <https://docs.fcc.gov/public/attachments/DA-19-977A1.pdf>.

⁴⁷ The value of EBS and BRS spectrum has been debated for some time. Given the high demand for mid-band spectrum in addition to previous valuation suggestions, we use a price of \$0.50 per MHz-POP to conclude a reasonable estimation of \$31.7 billion. Selling 94 MHz at this pricing would earn New T-Mobile approximately \$15.37 billion. For more analysis, please visit: <https://ecfsapi.fcc.gov/file/7022310781.pdf>.

EXHIBIT 1

DECLARATION OF JOHN SCHWARTZ

DECLARATION OF JOHN SCHWARTZ
Chief Executive, Voqal

Background and Qualifications

1. My name is John Schwartz. In 1983, I established five non-profit organizations that hold Federal Communications Commission licenses in the Educational Broadband Service (EBS). Those organizations have since adopted Voqal as their joint trade name. I have served as chief executive of the five Voqal entities since their founding. During the past 35 years, I have observed the evolution of EBS and the frequency band where it is located, commonly referred to as the 2.5 GHz band, or simply the 2.5 band. I have had extensive contact with EBS licensees, attorneys and engineers representing EBS licensees, and commercial users of 2.5 GHz spectrum. I have negotiated many spectrum usage contracts over the decades, beginning in the mid-1980s with contracts that contemplated pay TV usage and later those that were based on wireless broadband. In addition to negotiating spectrum agreements on behalf of the Voqal entities, I have done so on behalf of a Voqal-owned entity known as Independent Spectrum (IS). Independent Spectrum and its affiliates have entered into or brokered more than 30 2.5 GHz band spectrum transactions, including the purchase of four EBS systems, the purchase of one Broadband Radio Service (BRS) system, and the leasing and subleasing of EBS capacity in many markets, ranging in size from Paragould, Arkansas to Minneapolis, Minnesota. The 2.5 GHz capacity acquired or brokered by Independent Spectrum was leased or subleased to Clearwire, and, later, to Sprint. IS negotiated and concluded such transactions during a period that spanned from 2006 through 2015. I am closely familiar with the business environment of the 2.5 GHz band as it has evolved over the years, as well as the regulation and educational uses of EBS spectrum.

General Context for the Market for 2.5 GHz Spectrum

2. The 2.5 GHz Band is divided into Educational Broadband Service (EBS) and Broadband Radio Service (BRS),¹ as indicated in Exhibit I to this Declaration, entitled “BRS-EBS Band Plans: Pre-Transition at 2500-2690 MHz & Post-Transition at 2495 – 2690 MHz.”² The top band plan shows the alignment of EBS and BRS spectrum prior to a reorganization first mandated by the Commission in rules promulgated in 2004 and later tweaked on reconsideration.³ The bottom (post-transition) band plan is current.
3. The transition from the top band plan to the bottom band plan was effected separately in each Basic Trading Area (BTA) on different schedules, often as determined by a private-sector “proponent” who paid transition expenses for EBS licensees. Band plan transitions for certain major markets were completed in 2007 and the process was concluded nationwide by late 2010, with isolated exceptions.
4. The post-transition 2.5 GHz plan extends from 2496 MHz to 2690 MHz (excluding the one MHz guard band occupying 2495-2496 MHz). As one can see in Exhibit I, the 2.5 GHz band is divided into three segments: the lower band segment (2496 – 2568 MHz), the middle band

¹ BRS is a commercial radio service operating in the 2.5 band that is essentially identical to EBS in its technical characteristics.

² This document was prepared by the Commission.

³ The EBS/BRS band plan transition occurred pursuant to the requirements of a report and order released in 2004 and then revised in certain respects on reconsideration. *See Report and Order and Further Notice of Proposed Rulemaking, 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*, 19 FCC Rcd 14165; *Order on Reconsideration and Fifth Memorandum Opinion and Order and Third Memorandum Opinion and Order and Second Report and Order, 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*, 21 FCC Rcd 5606 (2006).

segment (2572 – 2614 MHz),⁴ and the upper band segment (2618 – 2690 MHz). These segments are intuitively abbreviated LBS, MBS, and UBS. The Commission's original thinking was that traditional high-power video transmission could occur in the MBS, where this use would be isolated from low-power two-way wireless broadband transmission in the LBS and UBS.⁵ Both 4G and 5G service operate at relatively low power and are incompatible with local high-power video use on the same frequency.

5. To enhance the separation of high and low power transmission, the FCC mandated that two 4 MHz wide blocks of spectrum on each side of the mid-band segment serve as guard bands. The lower of these two chunks is designated the J block and the upper is designated the K block. Small slices of the J block are licensed to the entities that hold licenses in the A, B, C, and D group EBS channels of the lower band segment. Small slices of the K block are licensed to entities that hold E, F, and H BRS channels in the upper band segment, as well as G group EBS channels in the upper band segment.⁶
6. High power use of EBS spectrum (e.g., video transmission) has now ceased in almost all major metropolitan areas. Hence, it is feasible to use MBS, J-block, and K-block spectrum for such purposes as 4G and 5G almost anywhere 2.5 GHz spectrum is allocated nationwide.
7. In practice, the carriers transmitted over EBS and BRS spectrum are wider than the underlying licensed channel frequencies, so they overlap multiple channels. According to engineering measurements Voqal has undertaken with fellow EBS licensee North American

⁴ The term "middle band segment" refers to its placement in the middle of the EBS band. This term is not the same as so-called midband spectrum, a phrase which is commonly used but does not have a universal definition; midband spectrum can be applied to spectrum that is greater in frequency than 1 GHz and in some cases as high as 6 GHz.

⁵ See 47 USC 27.55(a)(4).

⁶ See 47 USC 27.5(i). Officially, the J block is part of the LBS and the K block is part of the UBS. LBS and UBS main channels are each 5.5 MHz wide and the corresponding J and K block channels are one third of a MHz wide.

Catholic Educational Programming Foundation (NACEPF), Sprint is currently deploying 20 MHz carriers for 4G LTE. In markets where we measured, where Sprint deployed two 20 MHz LTE carriers side-by-side, it used BRS UBS spectrum only; in those where Sprint deployed three adjacent 20 MHz channels, it used BRS spectrum and adjacent EBS spectrum in the UBS. Based upon our limited sample, it appears that Sprint uses three carriers in top markets and two carriers in mid-sized markets, as it deployed two 20 MHz channels in the York, Pennsylvania area and three in Philadelphia and Minneapolis. In a regulatory filing, Sprint confirmed that its practice is to aggregate either two or three 20 MHz channels at “nearly every Sprint 2.5 GHz site.”⁷

8. Our engineering measurements pertained to transmissions from Sprint’s “macro” cell sites, and Sprint’s regulatory filing appears to do so too. Sprint also deploys LTE via small cells and so-called “Magic Boxes,” which reportedly operate at low power and use different 2.5 frequencies than the macro network as a means to avoid self-interference.
9. Although the 2004 reorganization of the EBS/BRS band plan created greater contiguity of both EBS spectrum and BRS spectrum, the two services’ frequencies remain intertwined and interdependent for deployment of very wide carriers.
10. The greatest extent of contiguous spectrum for either EBS or BRS is to be found in the EBS spectrum in the LBS, J block (which is assigned exclusively to EBS licensees in the LBS), and the bottom five channels of the MBS. This swath is 112 MHz from bottom to top. The greatest extent of contiguous BRS spectrum is 55.5 MHz; all of this spectrum is located in the UBS, and it extends from the bottom of channel BRS-2 to the top of BRS channel H3.

⁷ Comments of Sprint at 3, *Transforming the 2.5 GHz Band* (“2.5 NPRM”), WT Docket No. 18-120 (August 8, 2018) (“Sprint Comments”).

BRS channels F4 and E4 are separated from this 55.5 MHz swath by the K block, part of which is assigned to the licensee(s) of the EBS G group.

11. There are isolated parts of EBS and BRS in the band. The EBS G group is isolated at the top of the UBS and it also contains one 6 MHz channel in the MBS, separated from the rest of the G group by BRS-2 and BRS channel groups E, F, and H.⁸ Channel BRS-1 is located at the very bottom of the LBS, separated from the rest of BRS spectrum by 112 MHz of EBS.

License Eligibility in the 2.5 GHz Band

12. With rare exceptions, FCC rules provide that EBS licenses are to be issued only to accredited educational institutions, governmental organizations engaged in the formal education of enrolled students, and nonprofit organizations whose purposes are educational and include providing educational and instructional service to such accredited institutions and governmental organizations.⁹ An FCC rulemaking is now in progress under which the Commission is studying revisions of its rules governing EBS. In the pertinent Notice of Proposed Rulemaking (NPRM), the FCC proposed to abolish the educational set-aside contained in 47 CFR § 27.1201(a).¹⁰

⁸ Reflecting the value of spectrum contiguity, the fact that the G group is adjacent to commercial channels is considered to give it greater value. *See* Comments of The Wireless Communications Association International (WCAI) at 33, 2.5 *NPRM*. WCAI avers that the “G1-3 channels are far more valuable to a commercial operator that already is licensed to the E and F group BRS spectrum than a lower band channel (A, B, C, or D Groups).” *Id.*

⁹ *See* 47 USC 27.1201(a).

¹⁰ Notice of Proposed Rulemaking (“Notice”) at ¶ 20, 2.5 *NPRM*, WT Docket No. 18-120, (rel. May 10, 2018).

13. BRS licenses can be awarded to any type of licensee, for-profit or nonprofit. In practice, with rare exceptions, BRS licenses are held by for-profit entities. The bulk of BRS licenses in urban areas of the United States are licensed to subsidiaries of Sprint.¹¹
14. The FCC requires EBS licensees to reserve at least 5% of their spectrum capacity for educational use and to deploy no less than 20 hours per channel per week for education.¹²
- There is no such holdback or usage requirement for BRS spectrum.

A Short History of EBS

15. Before the 2004 re-regulation by the FCC, EBS was known as the Instructional Television Fixed Service (ITFS). The FCC originally allocated the 2.5 band for ITFS in 1963.¹³
- Pursuant to FCC rules, ITFS transmitted one-way analog video to locations like school classrooms and all ITFS use was required to be educational in nature. For the first two decades, ITFS was little deployed, largely due to the expense of the technology and lack of funding.
16. Partly in response to demand from pay television interests for greater channel capacity, in 1983 the Commission reassigned some ITFS channels to a commercial service then known as the Multi-channel Multipoint Distribution Service (MMDS---later renamed BRS).¹⁴ The

¹¹ Description of Transaction, Public Interest Statement, and Related Demonstrations (“Statement”), WT Docket No. 18-203 (June 18, 2018), Exhibit M-3 at 136-270.

¹² See Section 27.1214(b) of the FCC’s rules.

¹³ See Report and Order, *Amendment of Parts 2 and 74 of the Commission’s Rules and Regulations to Establish a New Class of Educational Television Station of 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*, 39 F.C.C. 846 (1963), *on recon.* 39 F.C.C. 873 (1964).

¹⁴ Report and Order, *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 Operation Fixed Microwave Service*, 94 F.C.C.2d 1203 (1983).

Commission also decided to permit ITFS licensees to lease some of their capacity for commercial purposes, which at the time was pay TV—a service that came to be known, oxymoronically, as wireless cable. The advent of leasing led to the rapid expansion in ITFS licensing, with commercial operators often sponsoring school districts and other eligible entities to apply.

17. Over the subsequent decades, the Commission took steps to expand ITFS licensees' interference protection. Currently, that protection is based upon a circular area with a 35-mile radius around a geographic centerpoint.¹⁵ MMDS interference protection grew in tandem with ITFS's, but in 1996 the Commission concluded an "overlay" MMDS spectrum auction by which it sold MMDS spectrum by BTA. Those newly-auctioned spectrum rights excluded the then-existing protected zones of MMDS stations, which the FCC had previously licensed in numerous markets, including substantially all major metropolitan areas. Wireless cable companies were the chief buyers in the 1996 MMDS overlay auction.
18. Between 1983 and the late 1990s, the wireless cable industry emerged, operated, and, ultimately, went out of business.
19. Despite the fact that wireless broadband and wireless cable are very different services, many characteristics of the 2.5 band can be traced to its video origins. It was important for wireless cable operators to obtain as many MMDS and ITFS channels as possible, since they needed a comparable number of channels as their conventional cable TV competitors. Typically, a

¹⁵ In cases where EBS stations are licensed within 70 miles of each other, their circular service areas overlap, creating a football-shaped area where originally both had interference rights. Because those overlaps essentially froze the use of the spectrum within them, the FCC later decided to bisect the footballs and assign half exclusively to the closest licensee. There are many cases of such "split footballs" in the licensed area of EBS stations. Possibly again extending the geographic reach of EBS stations' licensed service areas is a topic in the WT Docket 18-120 rulemaking now pending before the FCC.

local wireless cable operator would lease or purchase as many MMDS channels it could—with BTA rights, if possible—as well as lease as many ITFS channels as feasible. A wireless cable operator would seek to place all local ITFS and MMDS transmission facilities at a single centrally-located site—such as a tall tower, a mountaintop, or a downtown skyscraper—so that a customer could pick up the signal with a single rooftop receiving antenna.

20. Over time, wireless cable companies merged into a relatively small number of larger firms.

These companies became sizable enough that they sold their stock on public markets.

Because of channel capacity limitations and continued technical innovation by competitors, the large wireless cable companies became financially distressed. At least three publicly-

traded firms---CAI Wireless Systems, Wireless One, and Heartland Wireless

Communications¹⁶—went into bankruptcy. Fellow wireless cable firms ran short of cash and neared bankruptcy. Sensing a spectrum opportunity, WorldCom purchased the assets of CAI Wireless Systems and other teetering wireless cable companies. These purchases entailed acquiring MMDS (now BRS) licenses, and ITFS (now EBS) lease rights. Sprint purchased a different cohort of distressed wireless cable firms, including their spectrum rights.

WorldCom went into bankruptcy three years after it acquired 2.5 GHz spectrum rights.

WorldCom's rights were purchased from its bankruptcy estate by Nextel, which also bought Nucentrix's spectrum assets from bankruptcy. Like ever-larger fish consuming each other in the food chain, in 2005 Sprint and Nextel merged, leading to a combination of their already-extensive 2.5 spectrum portfolios.

¹⁶ Heartland was later renamed Nucentrix Broadband Networks.

21. This pattern of spectrum consolidation was disrupted when newcomer Clearwire began accumulating 2.5 GHz spectrum through ITFS leasing and MMDS license purchases. Clearwire began amassing 2.5 spectrum in 2001, and in 2003 was acquired by a firm controlled by Craig McCaw, the pioneering wireless entrepreneur. There ensued a period of rivalry to acquire spectrum assets, which grew intense between 2003 and 2008. That rivalry ended in 2008 when Sprint and Clearwire combined their 2.5 spectrum rights into Clearwire, and Sprint acquired majority ownership in Clearwire. In mid-2013, Sprint bought 100% ownership of Clearwire. Almost immediately thereafter, Softbank bought a controlling interest in Sprint.
22. As part of the 2004 re-regulation of the 2.5 GHz band, EBS and BRS spectrum leasing was brought under the Commission's omnibus "secondary markets" spectrum leasing rules. The maximum term for EBS leases was extended from 15 years to 30 years, and *de facto* transfer leasing became the norm.¹⁷
23. Because of this history, almost all 2.5 GHz spectrum is allocated in any former wireless cable market, including all major markets. During the wireless cable period, the bulk of channels operated from a single location, and given that the FCC provides EBS interference protection in a 35-mile radius from a given spot, the geographic centerpoints of various EBS licenses in a given area are usually the same.

¹⁷ *De facto* transfer leases assign control of most aspects of the leased spectrum to the lessee. Because that means a transfer of control within the meaning of the Communications Act, such leases require advance FCC approval. EBS leases that originated before 2004 were grandfathered, meaning that they were exempted from the *de facto* transfer approval process and allowed to expire in the normal course. Many grandfathered leases were written with one-way video usage in mind, and did not confer spectrum rights for wireless broadband. Almost all grandfathered EBS leases have now expired, and any remaining will expire by 2019.

24. The vast majority of 2.5 GHz spectrum rights in a given market tended to be held by the same entity. And because of a series of combinations of wireless operators, Sprint ultimately acquired an overwhelming position in essentially all major US cities. As Sprint's most recent SEC 10-Q indicates, it has "spectrum holdings of more than 160 MHz of 2.5 GHz spectrum in the top 100 markets in the U.S."¹⁸ Note that to control more than 160 MHz of 194 MHz in the 2.5 GHz band is to control 82% of it. Clearwire's SEC filings contained more details about its spectrum holdings than Sprint's do now. According to Clearwire's December 31, 2012 10-K filing—its last annual report—it controlled over 47 billion MHz-POPs of 2.5 spectrum. Of that total, almost 60% was leased from third parties and the average remaining lease term was then 23 years.¹⁹
25. In a recent FCC filing, Sprint reported that it "utilizes over 1000 BRS licenses (both site-based and wide-area geographic auctioned licenses) and leases approximately 1500 EBS licenses (over 67% of all EBS licenses at 2.5 GHz) to provide its service to customers."²⁰ EBS licensees rely on royalty payments from spectrum leases to support their operations,²¹ as well as access to the Sprint LTE network to deliver wireless broadband service to educational end users.
26. For both historical and business reasons, Sprint controls different amounts and configurations of spectrum in top metropolitan areas. For instance, it controls all of the allocated EBS/BRS channels in such Cellular Market Areas (CMAs) as Chicago, Washington DC, Pittsburgh,

¹⁸ Sprint, Form 10-Q at 42 (2018), <https://www.sec.gov/Archives/edgar/data/101830/000010183018000037/sprintcorp6-30x1810q.htm>.

¹⁹ Clearwire, Form 10-K at 18 (2012), <https://www.sec.gov/Archives/edgar/data/1442505/000144250513000015/clwr1231201210-k.htm>.

²⁰ Sprint Comments at 3, 2.5 NPRM.

²¹ Voqal derives the majority of its revenue from such royalties, for instance.

Miami, Baltimore, Minneapolis-St. Paul, Denver, and Phoenix,²² whereas it has lesser control over the 2.5 GHz band in such CMAs as New York City and Las Vegas, NV.²³

27. On average, Sprint has lesser 2.5 GHz spectrum positions in small-market CMAs.²⁴

However, even in these locations, its level of control is anti-competitive. In a recent FCC filing, The Wireless Internet Service Providers Association—a trade group of rural wireless entities—wrote that “Sprint, by far the largest holder of EBS lease rights, generally has not been willing to assign or sublease its EBS spectrum, even in rural markets where it has not deployed commercial service and may not deploy service for several years.”²⁵ Idaho’s Coeur D’Alene Tribe offered similar observations in the same EBS-related proceeding.²⁶

Favorable Technical Characteristics of the 2.5 GHz Band

28. As the Commission observed in the pending 2.5 GHz NPRM, the “2.5 GHz band (2496-2690 MHz) constitutes the single largest band of contiguous spectrum below 3 gigahertz and has been identified as prime spectrum for next generation mobile operations, including 5G uses.”²⁷ 3 GHz was traditionally considered to be the upper bound of spectrum suitable for mobile purposes. This makes the 2.5 GHz band prime territory for the deployment of wide carriers for purposes such as 5G. Press reports this year have indicated that Sprint is

²² Statement, Exhibit M-3. In some of these Cellular Market areas, Sprint lacks access to one or more channels in what appear to be exurban portions of the CMA. Exhibit M does not report Sprint’s control over channels licensed to the University of Colorado in the Denver CMA, but according to a recent FCC filing it has leased that capacity.

²³ Statement, Exhibit M-3.

²⁴ *Id.*

²⁵ Comments of The Wireless Internet Service Providers Association at 5, 2.5 NPRM.

²⁶ Comments of Coeur D’Alene Tribe at 1, 2.5 NPRM (“Often, commercial telecommunications companies will hoard licenses without serving customers, sometimes refusing to negotiate with tribes to access them”).

²⁷ Notice at ¶ 1. In its comments in the same proceeding, Verizon makes a nearly identical comment: “the 2.5 GHz band constitutes the single largest band of contiguous spectrum below 3 GHz that could be used for 5G.” Comments of Verizon at 1, 2.5 NPRM.

planning to deploy carrier width greater than 100 MHz for 5G purposes.²⁸ Because of the way that other relevant spectrum bands below 3 GHz are organized by the FCC, it would not be possible to deploy 100 MHz carriers there—or even carriers of somewhat lesser width.²⁹

29. Though not required by regulation, wireless broadband transmissions in the 2.5 band in the United States employ Time Division Duplexing (TDD). TDD transmissions use the same frequencies for upstream and downstream purposes;³⁰ the network assigns certain time slots for upstream use and others for downstream use. Advocates for TDD point out that greater numbers of slots can be assigned for upstream or downstream traffic, as required. Because, on average, more traffic is downstream than upstream in wireless networks today, more TDD time slots are usually assigned for downstream purposes.

30. 2.5 GHz spectrum is allotted for wireless broadband purposes not only in the United States, but also in such major telecommunications markets as China and Japan. The standards body for LTE has recognized the use of 2.5 spectrum and designated it as Band 41. Because of economies of scale, there is a robust ecology of both network equipment and wireless devices in the 2.5 GHz band. In the T-Mobile – Sprint merger application, the parties indicated that

²⁸ Sprint CEO John Saw is quoted as saying: “Sprint is the only carrier that doesn’t have to compromise what 5G can deliver because we can deliver super wide channels of more than 100 MHz while still delivering mid-band coverage characteristics...” Mike Dano, “Sprint promises to launch nationwide mobile 5G Network in first half of 2019,” *FierceWireless* (February 2, 2018), <https://www.fiercewireless.com/5g/sprint-promises-to-launch-nationwide-mobile-5g-network-first-half-2019-and-to-raise-unlimited>.

²⁹ The layout and control of numerous wireless spectrum bands is set forth in the T-Mobile/Sprint FCC merger application, Exhibit M. This information demonstrates that comparable configurations of spectrum are not available, except in very high-frequency “millimeter wave” bands.

³⁰ In mobile networks, upstream refers to transmission from a mobile device like a cellphone to the base station. Downstream refers to the path from the base station to the mobile device. The other principal architecture uses different frequencies for upstream and downstream transmissions. This architecture is known as Frequency Division Duplex, or FDD. Though this varies, in many bands regulatory bodies allot equal amounts of paired upstream and downstream frequencies—a practice that is well suited for voice traffic, but not for data traffic.

the post-merger entity (“New T-Mobile”) plans to devote all of its 2.5 spectrum to 5G purposes.

31. A cutting-edge wireless technology known as Multiple-In Multiple-Out (MIMO) antennas favors both TDD and 2.5 GHz spectrum. MIMO antennas contain multiple transmitting/receiving antennas in a single housing. The use of MIMO produces higher data rates and improved signal coverage. Very large arrays of MIMO antennas (128 antennas per housing in a current design) produce even greater improvements; they are referred to as Massive MIMO. TDD is more suited for MIMO because antennas work best the closer the signal is to the center frequency of an antenna. Because FDD involves separating frequencies into upstream and downstream bands with an often-large guard band in between, its frequencies tend to be organized in a less compact fashion than TDD.³¹ 2.5 spectrum is more suited to multiple antenna arrays because 2.5 GHz wavelengths are relatively short, and antennas are usually built as one wave in length (or a fraction of a wavelength, such as half). Longer wavelengths (such as 700 or 800 MHz, which are commonly used for wireless broadband in the United States) force Massive MIMO antenna housings to be prohibitively large for deployment on typical supporting structures. Because 5G will entail very dense coverage, antennas are expected to be placed on ubiquitous items like utility poles. Small supporting structures require small antennas.

Anticompetitive Harm Traceable to Sprint’s Current Position in the 2.5 Band Spectrum Market - Harm to Competition in the Sale and Leasing of 2.5 GHz Spectrum

³¹ Consider AWS spectrum in the United States, for instance, where paired channels are separated by approximately 400 MHz.

32. Only Sprint has a national portfolio of 2.5 GHz spectrum holdings in U.S. urban markets. In the wake of the 2004 rule changes, the standard EBS lease term extended from 15 to 30 years. Almost all 15-year leases have now expired. The first 30-year leases were executed in 2004, and thus will not expire until 2034. Other wireless carriers do not want to acquire isolated spectrum positions, and there is no longer frequent opportunity to take advantage of lease expirations. Ownership of BRS licenses is also highly concentrated. For all these reasons, Sprint has no significant competition for new or renewing 2.5 GHz spectrum leases in major US markets.
33. If the FCC follows through with proposed changes in the eligibility to hold EBS licenses, Sprint will be the only major buyer for EBS spectrum, as it has massive lease holdings and thereby encumbers approximately 1500 existing licenses with leases that average about 20 more years in duration.
34. This extensive level of control over so much 2.5 spectrum has not always existed. From approximately 2003 to 2008, Clearwire and Sprint competed for rights to use 2.5 GHz spectrum. A significant amount of EBS spectrum was available during this period. Not only was there unleased spectrum, but also because the FCC-imposed maximum length of EBS leases was 15 years prior to 2004, during 2003 - 2008 a significant number of key EBS leases expired.³² As well, some BRS spectrum was then available for sale, most notably Bell

³² A third acquirer of EBS and BRS spectrum also was active during part of this period: NextWave Broadband. Though NextWave never operated commercial networks using the 2.5 GHz band, it had substantial financial resources. NextWave's successors still hold 2.5 GHz spectrum assets in such markets as New York, San Francisco, and Las Vegas.

South's portfolio in the Southeast. Clearwire purchased BellSouth's 2.5 spectrum rights from AT&T in 2007 for \$300 million.³³

35. Virtually all EBS leases and BRS purchase contracts contain confidentiality clauses that prohibit the disclosure of their terms. Thus the bulk of examples of EBS leases that are available to the public are those that are concluded by governmental entities in states that require disclosure under sunshine statutes. Voqal and Independent Spectrum are non-governmental entities, and thus their contracts with Clearwire and Sprint remain confidential.³⁴
36. Notwithstanding spectrum lessees' efforts to hide transactions under a blanket of confidentiality, over the years I have received numerous accounts of deal-making trends from a community of people involved in 2.5 GHz spectrum negotiations and transactions. In this declaration I am relying solely on information that is either public or that I received absent an agreement of confidentiality with the source and that is not subject to any confidentiality requirement as far as I know.
37. Because the proposed T-Mobile – Sprint merger is subject to consideration by a variety of federal authorities, regulators have the opportunity to obtain the record of transactions that is largely hidden from the public. I am confident as to what the FCC, Department of Justice, or other regulators will find if they investigate the history of transactions in the 2.5 band.

³³ *Reuters*, "AT&T To Sell Wireless Spectrum to Clearwire for \$300 Million," (last updated August 5, 2010), <https://www.cnbc.com/id/17240864>. BellSouth's 2.5 assets included both BRS licenses and EBS leases.

³⁴ Independent Spectrum has concluded spectrum agreements with a number of public bodies to lease or purchase their 2.5 GHz spectrum. Certain of those agreements between IS and governmental entities are public documents in that their disclosure is required under pertinent state law. IS was also involved in bidding unsuccessfully for spectrum licensed to governmental entities, sometimes pursuant to public processes.

38. Voqal and its Independent Spectrum affiliates were involved in negotiating wireless broadband spectrum agreements for a period beginning about 1999 and extending well into 2015. We and others involved in 2.5 band transactions observed marked changes in the spectrum leasing environment over those years.
39. As I gathered it, Sprint initially did not take Clearwire's 2.5 GHz spectrum acquisitions very seriously. However, as Clearwire amassed an increasing position in the 2.5 band, around 2006 Sprint began to bid vigorously for spectrum leasing opportunities and BRS spectrum purchases. Competition for EBS spectrum appeared to hit an apex around 2007. After Sprint and Clearwire combined their spectrum holdings in a 2008 transaction, average pricing for 2.5 GHz spectrum declined markedly. Post-2008, Independent Spectrum lowered its EBS leasing offers in some cases. It was clear that most EBS licensees' leasing opportunities had dimmed substantially.
40. Both the economic and non-economic terms of spectrum agreements concluded during the period of competition between Sprint and Clearwire (and, during certain years, NextWave as well) are much more favorable to lessors on average than those that were concluded after Sprint and Clearwire consolidated their 2.5 spectrum interests in 2008. With regard to such matters as royalties paid, I strongly expect that regulators will be able to identify a statistically verifiable pattern of lower compensation after the end of significant competition.
41. It is instructive to compare EBS lease pricing following the Sprint/Clearwire combination with pricing derived in partly comparable bands. For example, interesting data are available due to the public process of The School Board of Broward County, Florida in leasing the

capacity of its two EBS systems covering all of Broward County, as well as parts of Palm Beach and Miami-Dade Counties.³⁵

42. As compared with typical EBS licensees, Broward County enjoyed significant advantages. It held multiple licenses—one for the B channel group and one for the coveted G-group³⁶—in a major urban area where Clearwire (and later Sprint) needed more spectrum. Including J and K Block spectrum, these two licenses cover a total of 47 MHz. Broward County was advised by sophisticated legal and business counsel, including Select Spectrum, a firm that markets wireless spectrum in a variety of bands, including EBS. One would expect that Broward County would drive an unusually hard bargain and obtain an unusually good deal. I believe that it did both—as far as one can in the post-2008 environment. According to data presented to the School Board, in response to an RFP from Broward County Public Schools, Clearwire offered a lease valued at a net present value of \$0.16 per MHz/Pop in 2010. That offer was rejected. In 2012, Clearwire made an unsolicited offer for \$0.13 per MHz/Pop NPV. That second offer was also rejected. In June 2014, Sprint made an initial offer of \$0.18 per MHz/Pop NPV. After a multiple-bid process followed by two months of negotiations, Sprint delivered a final offer of \$0.25 per MHz/Pop NPV in October, 2014.³⁷ Broward County Public Schools accepted that \$0.25 offer.

³⁵ This data can be found in a background paper submitted to the Broward County Board of Education for its consideration of a proposed EBS lease:
[http://bcpsagenda.browardschools.com/agenda/01006/Item%20II-1%20\(17099\)/SUPP_DOCS/Exhibits/Doc3.pdf](http://bcpsagenda.browardschools.com/agenda/01006/Item%20II-1%20(17099)/SUPP_DOCS/Exhibits/Doc3.pdf), last accessed August 20, 2018 (“Broward Lease Background Paper”).

³⁶ The call letters of these EBS systems are KTZ22 and KLC80.

³⁷ Broward Lease Background Paper.

43. At essentially the same time that Broward County was concluding its 2.5 GHz negotiations, the FCC began to auction a total of 65 MHz in the AWS-3 band.³⁸ Unlike the Broward County negotiations, which entailed only one major carrier, AT&T, Verizon, T-Mobile, and DISH Network affiliates all bid extensively in the AWS-3 auction. Tellingly, Sprint did not bid for AWS-3 spectrum. Except for undesirable upstream-only channels, all frequencies sold in the AWS-3 auction for the Miami-Fort Lauderdale area sold for *more than 12 times* the unit price of the Broward County School board lease value. Nationwide, paired upstream/downstream spectrum sold for an average of \$2.71 per MHz/Pop in the AWS-3 auction, whereas the upstream-only channels went for an average of \$0.52 per MHz/Pop.³⁹
44. Spectrum in all AWS band channels lacks the key characteristics of the 2.5 GHz band, some of which have grown more salient with recent technological advances such as the establishment of 5G standards. AWS cannot be assembled to create nearly as many contiguous frequencies as EBS. The AWS band is designed for FDD purposes, whereas 2.5 is usable for TDD and TDD is better suited to Massive MIMO. AWS does not have the same equipment manufacturing ecology as 2.5 TDD, although AWS is a widely used band. Most of the foregoing factors favor EBS over AWS. However, AWS-3 spectrum has advantages of its own. It has propagation characteristics that are better than EBS's because the frequencies are lower. The FCC sold most AWS-3 spectrum with Economic Areas (EAs) as the geographic unit—much larger units than EBS GSAs—that major spectrum purchasers usually prefer. Another distinction between the AWS-3 auction results and the Broward

³⁸ FCC Auction 97, which opened on November 13, 2014 and closed on January 29, 2015.

³⁹ Phil Goldstein, "AWS-3 AUCTION RESULTS: AT&T leads with \$18.2B, Verizon at \$10.4B, Dish at \$10B and T-Mobile at \$1.8B," *FierceWireless* (January 30, 2015), <https://www.fiercewireless.com/wireless/aws-3-auction-results-at-t-leads-18-2b-verizon-at-10-4b-dish-at-10b-and-t-mobile-at-1-8b>.

County lease results is that the AWS-3 auction allotted licenses directly to winning bidders, whereas the winner of the Broward County spectrum received instead a 30-year lease. Most carriers would prefer to hold spectrum licenses directly.

45. The FCC broke AWS-3 spectrum into a six different packages for the purposes of the auction, two of which were upstream-only.

AWS-3 channel A1 is 5 MHz of unpaired upstream-only spectrum occupying 1695-1700 MHz.

AWS-3 channel B1 is 10 MHz of unpaired upstream-only spectrum occupying 1700-1710 MHz.

AWS-3 G channels are 10 MHz of paired spectrum occupying 1755-1760 and 2155-2160 MHz. The lower frequencies in this pair were assigned to upstream use and the upper frequencies were assigned to downstream use (an FDD configuration). It was auctioned by Cellular Market Area (CMA) as the geographic unit. Of the AWS-3 geographic units, CMAs are the closest in size to EBS service areas.

AWS-3 H and I channels are 10 MHz of paired spectrum occupying 1760-1765 and 2160-2165 MHz (H channels) and 1765-1770 and 2165-2170 MHz (I channels). The lower frequencies in these pairs were assigned to upstream use and the upper frequencies were assigned to downstream use (FDD). This spectrum was auctioned by Economic Area (EA) as the geographic unit---a substantially larger size than EBS service areas.

AWS-3 J channels are 20 MHz of paired spectrum occupying 1770-1780 and 2170-2180 MHz. The lower frequencies in this pair were assigned to upstream use and the upper

frequencies were assigned to downstream use (FDD). This spectrum was auctioned by Economic Area (EA) as the geographic unit.

46. As compared with the \$0.25 per MHz/Pop valuation of the Broward County School Board's EBS spectrum, here are the results for the Miami-Fort Lauderdale AWS-3 auction results:⁴⁰

<u>AWS-3 Channel(s)</u>	<u>Use</u>	<u>Winning Bidder</u>	<u>Winning Bid per MHz/POP</u>
Channel A1	Upstream-only	Northstar Wireless	\$ 0.09
Channel B1	Upstream-only	2014 AWS Spectrum Bidco	\$ 0.39
G Channels	FDD two-way	Northstar Wireless	\$3.72
H Channels	FDD two-way	T-Mobile	\$3.19
I Channels	FDD two-way	AT&T	\$3.08
J Channels	FDD two-way	AT&T	\$3.96

47. Upstream-only spectrum clearly was much less attractive in this auction than two-way FDD spectrum. However, only Sprint's market power can account for the bulk of the gap between AWS-3 two-way spectrum and EBS valuations, notwithstanding that they are not substitutes and that they have different characteristics, as described above.

Anticompetitive Harm Traceable to Sprint's Current Position in the 2.5 Band Spectrum Market - Harm to Competition in 4G and 5G Wireless Broadband Service to Consumers

48. Harm in the market for 4G and 5G wireless broadband service to consumers derives from Sprint's overwhelming position in 2.5 GHz spectrum. As Sprint executives frequently

⁴⁰ See <https://www.fcc.gov/document/auction-97-aws-3-winning-bidders> for a listing of AWS-3 winning bids. See FCC Public Notice DA 14-1018, Attachment A for a listing of all channels on auction, population, frequencies, and other key bidding information.

remark, there is no other band that combines the abundance of contiguous spectrum with the signal propagation and other technical advantages of 2.5. If competing providers are denied access to adequate amounts of 2.5 spectrum, they will be forced to rely on less effective spectrum bands. Hence they will be impeded in their ability to compete with the New T-Mobile in 4G service, and, especially, 5G.

Available Remedies and Their Practicality

49. If one wishes to apply remedies to both forms of competitive harms, one needs to start by considering the technical needs of wireless broadband providers. In a recent filing pertaining to the rules governing EBS, AT&T stressed spectrum acquirers' demand for "large blocks of spectrum covering broad geographic areas."⁴¹ Competition for 4G and 5G wireless broadband service would thus be increased markedly by making large blocks of contiguous 2.5 GHz spectrum available to one or more capable competitors to New T-Mobile.
50. I recommend that the Commission require divestiture of no less than one-third of Sprint's 2.5 GHz spectrum in each CMA *in a contiguous block*, unless that configuration is not available locally; in the event that lesser contiguity is available within a GSA, Sprint should be required to divest the greatest available quantity of contiguous spectrum, plus sufficient other nearly adjacent spectrum to constitute at least one-third of its CMA holdings as measured by MHz/Pops.
51. One way to accomplish such a goal would be to require divestiture of Sprint's BRS spectrum holdings combined with G-group EBS leases. BRS is licensed in larger geographic units because of the fact that the FCC carried out the 1996 MMDS overlay auction. Divestiture of

⁴¹ Comments of AT&T at 2, 2.5 *NPRM*. It is clear that AT&T would prefer to own 2.5 spectrum rights than lease them. See *id.* at 4-5 n.6.

spectrum that is licensed directly is less complex than divestiture in the form of assigning lease interests, as leases may require consent of the lessors.

52. More complex, but also feasible, would be to require Sprint to divest its EBS spectrum interests in all or part of the A, B, C, and D channel groups. This would require multiple lease divestitures in a given CMA, and AT&T, for one, has made clear that it would prefer to hold commercial licenses rather than lease from educational entities. However, the combination of this large volume of contiguous spectrum over large swaths of territory covered by Sprint's present leases would meet AT&T's expressed criterion of "large blocks of spectrum covering broad geographic areas." I believe that a large collection of EBS leases would find a capable buyer. For instance, in 2012 and 2013, when Clearwire was considering an offer from Sprint to purchase full ownership, other parties came forward to offer to acquire parts of its 2.5 GHz spectrum rights. DISH Network, for instance, offered to buy approximately 11.4 billion MHz-POPs in December, 2012.⁴² In April of the following year, "Party J" offered to acquire a package of spectrum leases.⁴³ Stock analysts opined at the time that Party J was Verizon.
53. I recommend requiring divestiture of upper band spectrum in roughly half of top CMAs, and requiring divestiture of lower band spectrum in the remainder. This would ensure that Sprint and any major competing spectrum user would have roughly equal positions, and that each

⁴² Clearwire, Form PRER14A at 27 (2013) ("The Preliminary 2012 DISH Proposal contemplated a purchase price of approximately \$2.2 billion in net proceeds to the Company for approximately 11.4 billion MHz-POPs and an option for DISH to purchase or lease an additional 2 MHz of spectrum nationwide").

⁴³ *Id.* at 38 ("On April 8, 2013, the Company received an unsolicited, non-binding written proposal from Party J, a strategic buyer, in which Party J offered to acquire Clearwire spectrum leases generally located in large markets that cover approximately 5 billion MHz-POPs at a gross price of approximately \$1.0 to \$1.5 billion, less the present value of the spectrum leases which could be substantial").

would possess directly licensed and leased spectrum in major markets. As well, it would create greater opportunities for EBS entities to lease spectrum or sell spectrum to at least two entities.

54. I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct. Executed on August 27, 2018.

/s/ John Schwartz

John Schwartz
Chief Executive
Voqal

EXHIBIT 2

EXCERPT FROM T- MOBILE AND SPRINT JOINT OPPOSITION

REDACTED – FOR PUBLIC INSPECTION

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)	
)	
Applications of T-Mobile US, Inc.)	WT Docket No. 18-197
)	
and)	
)	
Sprint Corporation)	
)	
For Consent to Transfer Control of the Licenses)	
and Authorizations)	

**JOINT OPPOSITION OF
T-MOBILE US, INC. AND SPRINT CORPORATION**

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September 17, 2018

5. There Are No Viable Alternatives for T-Mobile and Sprint to Provide a Comparably Robust, Nationwide 5G Network in the Same Timeframe

Petitioners are wrong that there are a number of alternatives to a merger available to both T-Mobile and Sprint that would provide the same benefits. Specifically, parties argue that the companies could: (1) obtain additional spectrum from the Commission;¹⁹³ (2) use technology such as massive MIMO to enhance coverage and capacity;¹⁹⁴ (3) enter into a roaming agreement;¹⁹⁵ or (4) enter into a network sharing arrangement.¹⁹⁶ Opponents have misconstrued the New T-Mobile network plan and failed to understand the fundamental assumptions associated with it. None of the proposed options raised by the petitioners would result in the same depth and breadth of capacity and coverage that will be delivered by New T-Mobile within the same timeframe.

a. There Are No Viable Near-Term Spectrum Alternatives Available

Some petitioners argue that T-Mobile and Sprint could simply participate in the upcoming millimeter wave band spectrum auctions or other not-yet-scheduled mid-band spectrum auctions to access the spectrum resources needed for 5G.¹⁹⁷ DISH goes even further, erroneously asserting that the New T-Mobile model is flawed because it does not include these additional spectrum bands,¹⁹⁸ despite those bands not being available within any defined time period. The millimeter wave band spectrum auction, while representing a valuable influx of

¹⁹³ *DISH Petition* at 28-29; *Free Press Petition* at 57; *Public Knowledge et al. Petition* at 36-39.

¹⁹⁴ *DISH Petition* at 31.

¹⁹⁵ *Id.* at 33.

¹⁹⁶ *Id.*; *Free Press Petition* at 59; *Public Knowledge et al. Petition* at 37.

¹⁹⁷ *DISH Petition* at 28-29; *Public Knowledge et al. Petition* at 38.

¹⁹⁸ *DISH Petition* at 29.

needed spectrum for dense urban deployments, would not remedy the spectrum deficits faced by either standalone company. Moreover, speculative mid-band spectrum auctions, which have not been scheduled and would not be available in the 2019 timeframe during which New T-Mobile will initiate deployment of its nationwide, wide scale 5G network, are not practical substitutions for the spectrum resources available in the transaction. The Commission should reject these flawed arguments regarding the use of alternative spectrum bands. Such bands are not viable spectrum solutions and would not enable the standalone companies to increase network capacity in the near term (or potentially ever, as the availability of almost all of this spectrum is uncertain).

For T-Mobile, viable mid-band spectrum is the missing spectrum resource it needs to meet consumer demands for more capacity.¹⁹⁹ For its part, Sprint lacks sufficient low-band spectrum needed to provide the robust, nationwide 5G coverage demanded by customers.²⁰⁰ The upcoming millimeter wave band spectrum auctions,²⁰¹ while representing a valuable influx of needed spectrum for dense urban deployments, would not remedy the spectrum deficits faced by either standalone company. While high-band spectrum will be invaluable for enhancing the capacity for 5G networks in discrete areas, and both standalone companies will consider auction participation,²⁰² this spectrum alone will not support the robust, nationwide 5G network that New

¹⁹⁹ Ray Decl. at ¶36.

²⁰⁰ PIS at 25.

²⁰¹ See *Auctions of Upper Microwave Flexible Use Licenses for Next-Generation Wireless Services*, AU Docket No. 18-85 (rel. April 17, 2018), <https://docs.fcc.gov/public/attachments/FCC-18-43A1.pdf>. See also Chairman Ajit Pai, *Coming Home*, FCC Blog (July 11, 2018), <https://www.fcc.gov/news-events/blog/2018/07/11/coming-home>.

²⁰² Ray Reply Decl. at ¶54. See also Mike Dano, *Sprint: Millimeter wave spectrum is ‘important part of our strategy going forward’*, FIERCEWIRELESS (May 3, 2018),

T-Mobile intends to deliver.²⁰³ Millimeter wave band spectrum can be used for short range, high capacity services, but will not serve users that require more wide-area wireless offerings—the short range associated with this spectrum makes it cost prohibitive to cover large geographic areas.²⁰⁴ In addition, there can be no assurance that either standalone company would be successful in obtaining needed spectrum in this (or any other future) auction.

Other parties suggest that there are a number of alternative mid-band spectrum bands for 5G that could be used by either company on a standalone basis to provide a comparable customer experience.²⁰⁵ Future mid-band spectrum auctions have not been scheduled, however, and such mid-band spectrum would not be available in the 2019 timeframe during which New T-Mobile will initiate deployment of its nationwide, wide scale 5G network. Accordingly, these bands are not practical substitutes for the spectrum resources involved in the transaction and cannot be relied upon for standalone development of a robust 5G network. In fact, the lack of available mid-band spectrum for 5G was highlighted by FCC Chairman Ajit Pai in testimony before the House Energy and Commerce Committee: “As you are well aware, there are no greenfield mid-

<https://www.fiercewireless.com/5g/sprint-millimeter-wave-spectrum-important-part-our-strategy-going-forward>.

²⁰³ Ray Reply Decl. at ¶54.

²⁰⁴ *Id.*

²⁰⁵ See *DISH Petition* at 28-29 (arguing that the Applicants ignore 200 megahertz of mid-band spectrum to be released in the next few years); *Public Knowledge et al. Petition* at 36-38 (suggesting the 3700-4200 MHz band and the 3.5 GHz CBRS spectrum).

band frequencies available for 5G.”²⁰⁶ This mid-band shortage is further demonstrated by the table that DISH provided in its petition:²⁰⁷

Table 6: Spectrum Pipeline

Band [1]	Frequencies [2]	Quantity [3]	Auction Date [4]
Mid-Band Spectrum			
3.5 GHz CBRS	3550 - 3700 MHz	Max 70 MHz licensed	Est. Late 2019 - Beyond
2.5 GHz EBS	2496 - 2690 MHz	18-114 MHz	Est. 2020 - Beyond
3.5 GHz	3450 - 3550 MHz	100 MHz	Est. 2020 - Beyond
C Band	3700 - 4200 MHz	100+ MHz	Est. 2021
NOAA Meteorological Spectrum	1675 - 1680 MHz	5 MHz	Beyond 2020
<i>Sub-total Mid-Band Spectrum</i>		293-389 MHz	
High-Band Spectrum			
28 GHz Band	27.5 - 28.35 GHz	850 MHz	November 2018
24 GHz Band	24.25 - 24.45 GHz	700 MHz	Est. Late 1Q 2019/2Q 2019
	24.75 - 25.25 GHz		
37 GHz Band	37.6 - 38.6 GHz	1,000 MHz	Est. Late 2019 - Beyond
47 GHz Band	47.2 - 48.2 GHz	1,000 MHz	Est. Late 2019 - Beyond
39 GHz Band	38.6 - 40.0 GHz	1,400 MHz	Est. 2020 - Beyond
42 GHz Band	42.0- 42.5 GHz	500 MHz	Est. 2020 - Beyond
<i>Sub-total High-Band Spectrum</i>		5,450 MHz	

At the earliest, there *may* be an auction of 70 megahertz of 3.5 GHz CBRS spectrum in late 2019, but the Commission has set no date and this auction might not occur until well after that.²⁰⁸ Assuming *arguendo* that the auction occurs in late 2019, which it may not, the auction itself is likely to take weeks or even months to complete. Following completion of the auction, winning bidders would be required to file applications and participate in a lengthy licensing

²⁰⁶ Testimony of Chairman Ajit Pai, *Oversight of the Federal Communications Commission*, U.S. House of Representatives, Committee on Energy and Commerce, Subcommittee on Communications and Technology (July 25, 2018), <https://docs.fcc.gov/public/attachments/DOC-352944A1.pdf>.

²⁰⁷ *DISH Petition* at Exhibit B, Table 6.

²⁰⁸ The 3.5 GHz CBRS spectrum has an active proceeding that has not been completed. See *Promoting Investment in the 3550-3700 MHz Band*, Notice of Proposed Rulemaking, 32 FCC Rcd 8071 (2017).

process before receiving authority to operate. In a very best case scenario, the 3.5 GHz CBRS spectrum *might* be available in the mid- to late-2020 timeframe. Standardization and handset development will also require time, further delaying use of this spectrum. As Applicants explained in the PIS, assuming the transaction closes sometime in 2019, New T-Mobile would initiate operations in its mid-band spectrum (and in other spectrum bands) shortly thereafter, well before any 3.5 GHz CBRS spectrum would be available.

More importantly, the 3.5 GHz CBRS spectrum suffers from a number of significant drawbacks: (1) this band has significant power restrictions that will inhibit a wireless provider from deploying this spectrum for a wide scale 5G coverage layer;²⁰⁹ (2) there are substantial sharing requirements with Federal and commercial incumbents that inhibit full deployment of the spectrum for 5G;²¹⁰ (3) the small geographic license areas limit 5G deployment;²¹¹ (4) there is no ability for a licensee to have a sufficient license term with a settled renewal expectancy under the current rules;²¹² (5) the technology development for this band has been focused on LTE, not 5G;²¹³ and (6) there is only 70 megahertz of total spectrum available for licensing (with only 40 megahertz available to a single licensee in a license area).²¹⁴ Therefore, the 3.5 GHz CBRS band is not a near-term viable spectrum alternative option for T-Mobile or Sprint for 5G network operations in the near term (or likely at any time, given the limitations of the spectrum band).

²⁰⁹ 47 C.F.R. §96.41(b).

²¹⁰ 47 C.F.R. §§96.15, 96.17, 96.21.

²¹¹ See e.g., *Ex Parte* Presentation of T-Mobile, GN Docket No. 17-258, at 1 (filed April 25, 2018).

²¹² 47 C.F.R. §96.25(b)(3).

²¹³ See e.g., CBRS Alliance, *Introducing OnGo*, <https://www.cbbsalliance.org/> (heralding the use of CBRS spectrum for secure, cost-effective LTE coverage indoors and private LTE networks).

²¹⁴ 47 C.F.R. §§96.13, 96.31.

The remaining spectrum bands identified by petitioners, including the 3700-4200 MHz band, the EBS band, and the 3450-3550 MHz band, are all in preliminary stages of consideration for repurposing to 5G services.²¹⁵ DISH makes this abundantly clear in its helpful table. It estimates that the *earliest* any Commission auction could occur in these bands would be sometime in 2020, but also notes that such auctions could occur well “beyond” that date.²¹⁶ In contrast, New T-Mobile will deploy a substantial portion of its 5G network in advance of this 2020 timeframe, assuming the transaction is approved.²¹⁷ If the Commission wants a cutting-edge, nationwide, robust 5G mobile network deployed in the United States before in other countries, it should not rely upon the speculative availability of other mid-band spectrum. Nor could T-Mobile and Sprint assume the availability of this additional spectrum into their ordinary course business plans, given the uncertain availability of that spectrum.

The best way to provide a robust 5G network is to utilize spectrum across all bands—low-, mid-, and high—with sufficient cell site density to deliver the multiplicative capacity increase needed for a robust 5G deployment.²¹⁸ This spectrum combination ensures a comprehensive band portfolio that accommodates all use cases, supporting full coverage and mobility on low-band spectrum and high or extremely high throughput and low latency on mid- or high-band spectrum.²¹⁹ By combining T-Mobile’s low- and high-band spectrum with Sprint’s mid-band spectrum, along with access to a dense cell site infrastructure,²²⁰ the transaction will

²¹⁵ *DISH Petition* at Exhibit B, Table 6; *Public Knowledge et al. Petition* at 36-38.

²¹⁶ *DISH Petition* at Exhibit B, Table 6.

²¹⁷ Ray Reply Decl. at ¶15.

²¹⁸ Ray Decl. at ¶52; PIS at 48.

²¹⁹ *Id.*

²²⁰ *Id.*

enable New T-Mobile to deploy a robust, nationwide 5G network with the full array of features and improvements promised by that standard.²²¹

²²¹ *Id.*

EXHIBIT 3

VOQAL DIVESTITURE PROPOSAL

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REDACTED – FOR PUBLIC INSPECTION

March 4, 2019

Via Hand Delivery

Secretary

Federal Communications Commission

445 12th Street, S.W.

Washington, D.C. 20554

**Re: Written Ex Parte Presentation
Applications of T-Mobile US, Inc. and Sprint Corporation for
Consent to Transfer Control of Licenses and Authorizations
WT Docket No. 18-197**

Dear Ms. Dortch:

Pursuant to Section 1.1206(b) of the Commission's rules, 47 C.F.R. Section 1.1206(b), and by counsel, Voqal hereby submits the attached written *ex parte* presentation.

This filing contains information that is "Confidential" pursuant to the Protective Order filed in WT Docket No. 18-197.¹ Pursuant to the procedures set forth therein, I am submitting one copy of this filing to the Secretary's Office. Additionally, two copies of this Confidential Filing are being delivered to Kathy Harris, Wireless Telecommunications Bureau. A copy of the Redacted Confidential Filing is being filed electronically using the Commission's Electronic Comment Filing System for inclusion in the public record of this Docket 18-197 proceeding.

Sincerely,

/s/ Mark Van Bergh

Mark Van Bergh

cc: Kathy Harris

¹ Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Assign Licenses, Protective Order, WT Docket No. 18-197, DA 18-624 (June 15, 2018)



2.5 GHz Spectrum Divestiture as a Condition for Approving the Sprint/T-Mobile Merger

Submitted to the Federal Communications Commission, March 4, 2019

Last year, Voqal formally petitioned the FCC to require significant 2.5 GHz spectrum divestiture as a condition to the Sprint/T-Mobile merger. In our filings, and a subsequent meeting with the Transaction Team, we set forth a number of options, which we have continued to refine. In this memorandum we focus principally on one possible divestiture alternative.

The Sprint/T-Mobile merger application overlaps the FCC's pending rulemaking in which it proposes extensive changes in Educational Broadband Service (EBS) regulation (WT Docket No. 18-120). The overlap of these two proceedings offers an unusually broad range of opportunities with respect to expanding the availability of 2.5 GHz spectrum.

I. Revised Recommendation

Upon further study Voqal recommends imposing a merger condition that roughly bisects the 2.5 GHz band and would require "New T-Mobile" to divest the highest 94 MHz of frequencies between 2596 and 2690 MHz. This divestiture would consist primarily of Broadband Radio Service (BRS) channels. We refer to this plan as "Top Half divestiture."

Bottom Half divestiture—requiring New T-Mobile to divest the lower 100 MHz of frequencies instead—also is an option, but not our primary recommendation because, while feasible, it is more complicated to implement. Our divestiture proposal is discussed further below.

II. Dividing the 2.5 GHz Band

Appendix A contains a diagram of the current 2.5 GHz band and the allocations for BRS and EBS.

The revised Voqal divestiture proposal divides the 194 MHz of the 2.5 GHz band into the Bottom Half of 100 MHz, which runs from 2496 through 2596 MHz, and the Top Half of 94 MHz, which runs from 2596 through 2690 MHz. The dividing line between the Bottom Half and the Top Half is the border between EBS Channel D4 (as the highest

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channel in the Bottom Half) and EBS Channel G4 (as the lowest channel in the Top Half).¹

III. Primary Proposed Merger Condition – Top Half Divestiture

A. The Two Halves of the 2.5 GHz Band.

The baseline divestiture would consist of all Sprint's current spectrum holdings in the Top Half.² The 94 MHz Top Half is a contiguous swath of spectrum composed of 70.5 MHz of BRS spectrum and 23.5 MHz of EBS spectrum.³ *BRS spectrum may be licensed to commercial entities.* Commercial entities are not presently allowed to hold EBS licenses, though they commonly lease excess capacity from EBS licensees.⁴ One proposal in the pending NPRM would allow commercial entities to acquire EBS licenses.

For the most part, in major markets Sprint holds licenses for the BRS spectrum it uses, though in a small number of cases Sprint leases it from a third-party BRS licensee. In other rare cases, there are available BRS channels that Sprint has failed either to buy or lease.

¹ Unlike the terminology of this memo, current FCC rules divide 2.5 GHz spectrum into three parts: the Lower Band Segment (LBS), the Midband Segment (MBS), and the Upper Band Segment (UBS). At the time it adopted current 2.5 GHz rules, the FCC contemplated that the MBS would be used for high power video transmission, whereas the LBS and UBS were reserved for low power wireless broadband. In order to isolate the high-power MBS, the FCC created guard bands that it dubbed the J and K blocks, each consisting of 4 MHz. The J block separates the LBS from the MBS, whereas the K block separates the UBS from the MBS. The FCC allotted one MHz of the J block to each of the licensees of the A, B, C, and D group EBS channels, with 1/3 of a MHz assigned to the holder of each LBS main channel. Similarly, 1/3 of a MHz of the K block is allotted to the licensee of each channel in the BRS E, F, and H groups in the UBS, as well as the EBS licensee of each G group EBS main channel. As there is currently very little high power use of the 2.5 GHz MBS frequencies, in most locations the J and K blocks have become suitable for wireless broadband use. However, the fact that the J and K blocks are located as they are in the band plan has important implications for what a carrier needs to do in order to maximize spectrum contiguity.

² Specifically, the Top Half consists of, from lowest to highest frequencies: MBS EBS channel G4 (6 MHz), MBS BRS channel F4 (6 MHz), MBS BRS channel E4 (6 MHz), BRS K block channels KH1 – KH3 (1 MHz), EBS K block channels KG1-KG3 (1 MHz), BRS K block channels KF1-KF3 (1 MHz), BRS K block channels KE1-KE3 (1 MHz), BRS channel 2 (6 MHz), BRS channels E1-E3 (16.5 MHz), BRS channels F1-F3 (16.5 MHz), BRS channels H1-H3 (16.5 MHz), and EBS channels G1-G3 (16.5 MHz).

³ Because the EBS KG channels isolate the BRS MBS channels and KH channels, the amount of contiguous BRS spectrum is 57.5 MHz.

⁴ A few EBS licenses are held by commercial entities based upon long-abandoned regulations allowing commercial operators to obtain licenses for a limited number of these channels. Commercial EBS licenses are located in smaller markets.

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The FCC initially licensed BRS spectrum in major metropolitan areas in the 1980s based upon localized protected service areas, resulting in a patchwork of BRS coverage. In the 1990s, the FCC held an “overlay” auction for BRS licenses based on Basic Trading Areas subject to the rights of the pre-existing incumbents. Through a series of combinations over the years, Sprint acquired all but a small number of incumbent licenses and almost all the BTA licenses. There are 487 BTAs in the United States. According to the FCC’s Universal Licensing System database, Sprint now holds BRS licenses covering 454 of these BTAs. The BTA licenses that Sprint does not hold are in secondary or tertiary-sized markets. In the rare case of BRS leases, the licensee usually holds a grandfathered localized license subsumed within one or more BTAs; Sprint leases capacity in that “Swiss cheese hole” within its otherwise fully-controlled BTA territory.

In sum, Sprint holds the right to deploy the vast bulk of BRS spectrum nationwide.

EBS is currently licensed based on localized, circular “geographic service areas” with a 35-mile radius. Currently unallocated EBS areas (referred to as “white space”) constitute about 50% of the US geographically, containing approximately 15% of the US population. The pending EBS rulemaking includes various proposals about how to allocate this EBS white space.

B. Effectuating the Primary Divestiture Proposal.

Licensed Spectrum. Under the divestiture proposal that we favor, the FCC would condition grant of the merger application on New T-Mobile divesting (selling) its licensed Top Half BRS spectrum within one year of closing the Sprint acquisition, as well as any commercial EBS G-Group spectrum New T-Mobile or its affiliates then hold as a licensee. It would have to divest all such spectrum to a single entity.

Leased Spectrum. For Sprint’s leased spectrum holdings in the Top Half, New T-Mobile (and any successor) would be required to unconditionally offer the lessors and sublessors (whether EBS or BRS) the right to terminate their existing leases/subleases with Sprint at any time, upon 6 months’ notice, and without providing any additional consideration to New T-Mobile/Sprint or incurring any penalty. The right of lessors to terminate these spectrum leases would last three years from the closing of the Sprint acquisition.

As explained above, the top half of the band includes a single EBS channel group, the G-group. There are hundreds of G-group EBS licensees, though many of them serve lightly populated areas. Generally, local entities hold EBS licenses, though some EBS organizations have national portfolios of licenses with multiple G-group authorizations. For instance, Voqal organizations hold G-group licenses in Philadelphia, Minneapolis, Indianapolis, and Las Vegas. The most complex part of the proposed Top Half divestiture involves reaching leasing or spectrum purchase agreements with what would

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almost surely be scores of different EBS licensees. However, even if the new entrant (acquiring the BRS licenses) cannot obtain the use of G-group EBS spectrum in certain locations, its BRS holdings alone (57.5 MHz of contiguous spectrum) would suffice to offer 5G service.

IV. Alternative Recommendation: Bottom Half Divestiture

The principal alternative to Top Half divestiture is to require divestiture of the Bottom Half of the 2.5 GHz band, consisting of 100 MHz of spectrum between 2496 to 2596 MHz. The Bottom half consists of one 6 MHz BRS channel (known as BRS-1) with the remainder composed of EBS spectrum.⁵

Bottom Half divestiture of the EBS portion (94 MHz of the 100 MHz) would be effectuated the same way as the proposed G-group Top Half divestiture: by requiring New T-Mobile to give spectrum licensees/lessors three-year lease termination options as a merger condition. Sprint also would have to sell its BRS-1 spectrum, which sits at the very bottom of the band.

Currently allocated EBS licenses cover roughly 85% of the US population. Assembling adequate Bottom Half coverage would involve working with hundreds of licensees rather than scores. However, this process could be simplified by making deals with “national” EBS licensees, thus reducing the necessary volume of transactions. See Appendix B which provides information about the holdings of the top five 2.5 GHz EBS licensees and lease holders.⁶ Also lessening the transaction burden is the fact that some local EBS licensees hold multiple licenses in their markets, including such major metropolitan areas as Boston, Phoenix, and Denver. Further, if the FCC decided to require Bottom Half Divestiture as a merger condition, it could encourage Bottom Half EBS licensees to form local consortia to negotiate leases with a new entrant.

BRS channel 1 is likely to be most valuable to an entity that has acquired use of the EBS A group and/or other Bottom Half EBS spectrum. Hence, Bottom Half BRS divestiture should follow Bottom Half EBS divestiture in time. We suggest that New T-Mobile be required to sell its BRS1 licenses to a nonaffiliate between three and four years after the merger closes.

⁵ Specifically these channels, from lowest to highest frequencies are: BRS channel 1 (6 MHz), EBS channels A1 – A3 (16.5 MHz), EBS channels B1 – B3 (16.5 MHz), EBS channels C1 – C3 (16.5 MHz), EBS channels D1 – D3 (16.5 MHz), EBS channels JA1 – JA3 (1 MHz), EBS channels JB1 – JB3 (1 MHz), EBS channels JC1 – JC3 (1 MHz), EBS channels JD1 – JD3 (1 MHz), EBS midband channel A4 (6 MHz), EBS midband channel B4 (6 MHz), EBS midband channel C4 (6 MHz), and EBS midband channel D4 (6 MHz).

⁶ The information in Appendix B includes a proprietary compilation of spectrum holdings provided to Voqal by a third party that has requested confidentiality for its work product. This firm has extensive experience working on spectrum-related matters, including the 2.5 GHz band. The information is submitted in redacted form pursuant to the Protective Order in WT Docket No. 18-197.

V. Relative Advantages and Disadvantages of Top Half Divestiture

Top Half divestiture is the most effective way to stimulate 5G competition because it will place a significant amount of midband spectrum in the hands of a national competitor. Given that Sprint now dominates Bottom Half spectrum through hundreds of EBS leases, New T-Mobile would retain ample 2.5 GHz spectrum for 5G purposes. Top Half divestiture also is much simpler to implement than Bottom Half Divestiture, though not free of complexity because of the number of G-group EBS licensees.

Another advantage is that because BRS is licensed on a BTA-wide basis, a new Top Half entrant would have access to wider geographic coverage uninterrupted by white space. It thus would have less reliance on the outcome of the current EBS rulemaking that is expected to create the framework for allocating EBS white space.

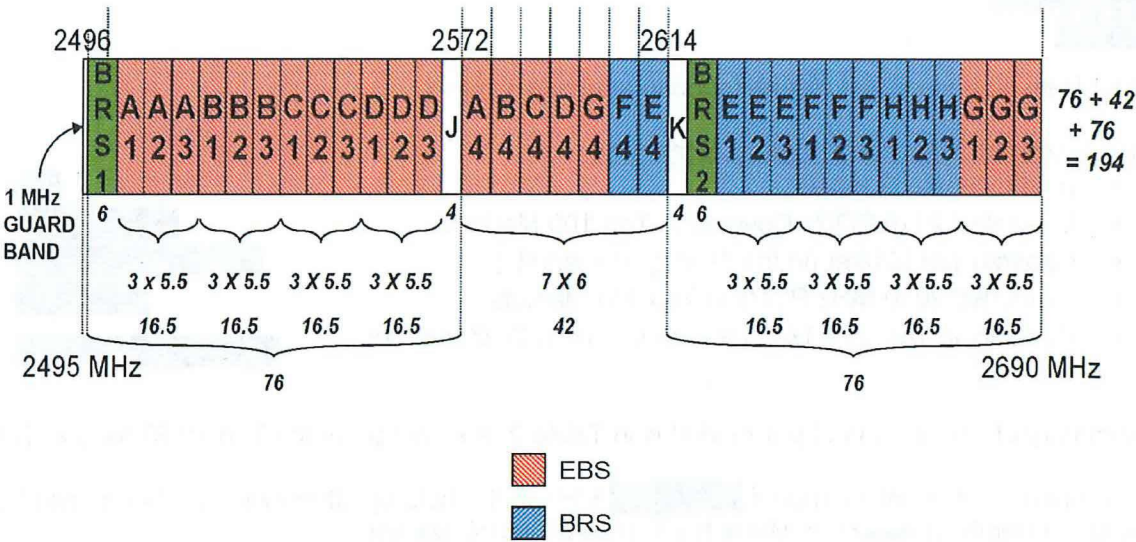
Sprint and T-Mobile are likely to object to Top Half divestiture, and for reasons beyond simple aversion to divesting spectrum. For example, in most areas Sprint has deployed its LTE services on BRS spectrum, supplemented by G group EBS channels in the larger markets. However, New T-Mobile's/Sprint's expected complaint of the inconvenience of divesting spectrum bearing deployed LTE service should be considered in light of announced plans that New T-Mobile would clear all LTE uses off the 2.5 GHz band in the near future and devote it to 5G exclusively.

Finally, the competitive concerns raised by New T-Mobile's proposed accumulation of spectrum generally, and in the 2.5 GHz band specifically, are sufficient to overcome objections to the proposed divestiture plan.

APPENDIX A

CURRENT 2.5 GHz (BRS-EBS) BAND PLAN – 2495-2690 MHz

SOURCE: <http://wireless.fcc.gov/services/brsebs/data/BRS-EBS-BandPlans.pdf>



Appendix B 2.5 GHz EBS Market Summary

Top 5 Non-Operating EBS License and Lease Holders¹:

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Total License/Lease ID list can be found in attached **Table 1**.

Top 5 License/Lease Holders Asset Summary:

- Held Licenses /Leases: [REDACTED]
- Estimated 2010 POPs Covered in Top 100 Markets: [REDACTED]
- Capacity per Market (in the 10 largest markets): [REDACTED]
- Estimated 2010 MHz POPs in Top 100 Markets: [REDACTED]
- Capacity in Top 30 BTAs⁴ (coverage only in 24 BTAs, per Table 3): [REDACTED]

A summary of spectrum held per market is in **Table 2**. A summary of the Top 30 BTAs is in **Table 3**.

There are an additional estimated [REDACTED] MHz POPs held by other existing EBS license holders that are currently unleased or where the leases will terminate soon.

Sprint now holds an estimated 1,600 leases with EBS license holders – primarily Educational Non-Profits, Private & Public Universities/Colleges, local county school boards and private/parochial schools.

Pending FCC NPRM EBS Spectrum Allocation:

- Will allocate anywhere from [REDACTED] of new EBS spectrum covering 39 million POPs across over [REDACTED] counties – estimated [REDACTED] MHz POPs in total
 - POPs to be allocated are roughly [REDACTED] rural, [REDACTED] urban
 - Counties to be allocated are approximately [REDACTED] Rural and [REDACTED] Urban
- If existing licenses expand to county borders, closing coverage gaps and increasing POPs covered – estimated [REDACTED] MHz POPs in total
 - Total MHz POPs expected to be allocated under NPRM – estimated [REDACTED] MHz POPs⁵

¹ These parties either hold spectrum licenses or are lessees but have not constructed and operated their own wireless networks. Capacity on most, but not all, of the EBS licenses has been leased to Sprint.

² Includes held [REDACTED] frequencies in [REDACTED].

³ POPs Data provided by Universal Licensing Service – 2010 FCC Spectrum Dashboard POPs.

⁴ Utilization of Basic Trading Area (BTA) market sizes in this case does not mean that 2.5 GHz EBS capacity/coverage is present or consistent across the entirety of the BTA market area(s).

⁵ Earlier analysis by another party suggested upwards of 6 billion MHz POPs might be allocated in the NPRM.

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Table 1: Total License/Lease List of Top 5 EBS License Holders

Call Sign	Channel Group	Lease	License / Lease Rights Holder	Center Market	Rank	MHz	2010 POPs	MHz POPs (2010)
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	New York City, NY	1	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	New York City, NY	1	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	New York City, NY	1	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	New York City, NY	1	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	New York City, NY	1	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	New York City, NY	1	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	New York City, NY	1	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	New York City, NY	1	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Chicago, IL	2	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Houston, TX	3	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Philadelphia, PA	4	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Philadelphia, PA	4	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Philadelphia, PA	4	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Washington, D.C. + Baltimore, MD	5	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Washington, D.C. + Baltimore, MD	5	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Washington, D.C. + Baltimore, MD	5	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Washington, D.C. + Baltimore, MD	5	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	San Francisco, CA	6	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	San Francisco, CA	6	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	San Francisco, CA	6	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Seattle, WA	7	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Seattle, WA	7	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Irvine, CA	8	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Phoenix, AZ	9	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Phoenix, AZ	9	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Phoenix, AZ	9	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Phoenix, AZ	9	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Minneapolis, MN	10	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Minneapolis, MN	10	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Long Island, NY	11	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Dallas, TX	12	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Denver, CO	13	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Denver, CO	13	[REDACTED]	[REDACTED]	[REDACTED]

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Call Sign	Channel Group	Lease	License / Lease Rights Holder	Center Market	Rank	MHz	2010 POPs	MHz POPs (2010)
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Pittsburgh, PA	14	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Pittsburgh, PA	14	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	St. Louis, MO	15	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Fort Worth, TX	16	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Fort Worth, TX	16	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Fort Worth, TX	16	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Sacramento, CA	17	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Sacramento, CA	17	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	San Juan, PR	18	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Hartford, CT	19	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Hartford, CT	19	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Las Vegas, NV	20	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Las Vegas, NV	20	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Las Vegas, NV	20	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Las Vegas, NV	20	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Las Vegas, NV	20	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Portland, OR	21	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Portland, OR	21	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Portland, OR	21	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Milwaukee, WI	22	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	San Antonio, TX	23	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	San Antonio, TX	23	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Cincinnati, OH	24	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Orlando, FL	25	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Columbus, OH	26	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Providence, RI	27	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Providence, RI	27	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Norfolk, VA	28	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Kansas City, MO	29	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Kansas City, MO	29	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Kansas City, MO	29	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Charlotte, NC	30	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Lancaster, PA	31	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Lancaster, PA	31	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Salt Lake City, UT	32	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Salt Lake City, UT	32	[REDACTED]	[REDACTED]	[REDACTED]

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Call Sign	Channel Group	Lease	License / Lease Rights Holder	Center Market	Rank	MHz	2010 POPs	MHz POPs (2010)
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Salt Lake City, UT	32	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Raleigh, NC	33	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Austin, TX	34	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	San Diego, CA	35	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	San Diego, CA	35	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Tampa, FL	36	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Tampa, FL	36	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Nashville, TN	37	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Harrisburg, PA	38	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Modesto, CA	39	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Dayton, OH	40	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Oklahoma City, OK	41	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Buffalo, NY	42	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Memphis, TN	43	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Memphis, TN	43	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Poughkeepsie, NY	44	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Poughkeepsie, NY	44	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Grand Rapids, MI	45	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Grand Rapids, MI	45	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	San Bernardino, CA	46	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	San Bernardino, CA	46	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Indianapolis, IN	47	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Indianapolis, IN	47	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Indianapolis, IN	47	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Rochester, NY	48	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Fresno, CA	49	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Fresno, CA	49	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	New Orleans, LA	50	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	New Orleans, LA	50	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Greenville, SC	51	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Tucson, AZ	52	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Honolulu, HI	53	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Honolulu, HI	53	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Bayville, NJ	54	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Bayville, NJ	54	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Jacksonville, FL	55	[REDACTED]	[REDACTED]	[REDACTED]

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Call Sign	Channel Group	Lease	License / Lease Rights Holder	Center Market	Rank	MHz	2010 POPs	MHz POPs (2010)
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Jacksonville, FL	55	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Jacksonville, FL	55	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Arecibo, PR	56	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Arecibo, PR	56	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Albany, NY	57	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Tulsa, OK	58	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	El Paso, TX	59	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	El Paso, TX	59	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Toledo, OH	60	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Youngstown, OH	61	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Syracuse, NY	62	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Melbourne, FL	63	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Albuquerque, NM	64	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Albuquerque, NM	64	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Albuquerque, NM	64	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Saginaw, MI	65	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Saginaw, MI	65	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Madison, WI	66	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Madison, WI	66	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	South Bend, IN	67	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Lansing, MI	68	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Colorado Springs, CO	69	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Colorado Springs, CO	69	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Hagerstown, MD	70	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Hagerstown, MD	70	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Atlantic City, NJ	71	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Little Rock, AR	72	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Des Moines, IA	73	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Spokane, WA	74	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Fort Wayne, IN	75	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Boise, ID	76	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Mobile, AL	77	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Mobile, AL	77	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Mobile, AL	77	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Port St. Lucie	78	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Fort Myers, FL	79	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Santa Rosa, CA	80	[REDACTED]	[REDACTED]	[REDACTED]

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Call Sign	Channel Group	Lease	License / Lease Rights Holder	Center Market	Rank	MHz	2010 POPs	MHz POPs (2010)
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Pensacola, FL	81	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Palm Springs, CA	82	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Davenport, IA	83	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Killeen, TX	84	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Killeen, TX	84	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Corpus Christi, TX	85	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Ocala, FL	86	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Omaha, NE	87	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Altoona, PA	88	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Bloomington, IN	89	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Sarasota, FL	90	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Utica, NY	91	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Mayaguez, PR	92	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Mayaguez, PR	92	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Mayaguez, PR	92	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Mayaguez, PR	92	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Fajardo, PR	93	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Fajardo, PR	93	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Rochester, MN	94	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Mandeville, LA	95	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Waterloo, IA	96	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Waterloo, IA	96	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Waterloo, IA	96	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Waterloo, IA	96	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Waterloo, IA	96	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Richland, WA	97	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Anchorage, AL	98	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Urbana, IL	99	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Waco, TX	100	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Waco, TX	100	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Monticello, NY	101	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Yakima, WA	102	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Charlottesville, VA	103	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Pittsfield, MA	104	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Sherman, TX	105	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Chico, CA	106	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	Chico, CA	106	[REDACTED]	[REDACTED]	[REDACTED]

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Call Sign	Channel Group	Lease	License / Lease Rights Holder	Center Market	Rank	MHz	2010 POPs	MHz POPs (2010)
██████	█	██████	██████	Chico, CA	106	████	██████	██████
██████	█	██████	██████	Chico, CA	106	████	██████	██████
██████	█	██████	██████	Yuba City, CA	107	████	██████	██████
██████	█	██████	██████	Hudson, NY	108	████	██████	██████
██████	█	██████	██████	Paducah, KY	109	████	██████	██████
██████	█	██████	██████	Jonesboro, AR	110	████	██████	██████
██████	█	██████	██████	Fargo, ND	111	████	██████	██████
██████	█	██████	██████	Fargo, ND	111	████	██████	██████
██████	█	██████	██████	Grand Junction, CO	112	████	██████	██████
██████	█	██████	██████	Yuma, AZ	113	████	██████	██████
██████	█	██████	██████	Calera, AL	114	████	██████	██████
██████	█	██████	██████	Hot Springs, AR	115	████	██████	██████
██████	█	██████	██████	Las Cruces, NM	116	████	██████	██████
██████	█	██████	██████	Lawton, OK	117	████	██████	██████
██████	█	██████	██████	Peoria, IL	118	████	██████	██████
██████	█	██████	██████	Jasper, AL	119	████	██████	██████
██████	█	██████	██████	Maui, HI	120	████	██████	██████
██████	█	██████	██████	Palestine, TX	121	████	██████	██████
██████	█	██████	██████	Palestine, TX	121	████	██████	██████
██████	█	██████	██████	Lebanon, NH	122	████	██████	██████
██████	█	██████	██████	Lebanon, NH	122	████	██████	██████
██████	█	██████	██████	Rapid City, SD	123	████	██████	██████
██████	█	██████	██████	Bullhead City, AZ	124	████	██████	██████
██████	█	██████	██████	Bullhead City, AZ	124	████	██████	██████
██████	█	██████	██████	Sierra Vista, AZ	125	████	██████	██████
██████	█	██████	██████	Stanislaus, CA	126	████	██████	██████
██████	█	██████	██████	Wenatchee, WA	127	████	██████	██████
██████	█	██████	██████	Burlington, VT	128	████	██████	██████
██████	█	██████	██████	Burlington, VT	128	████	██████	██████
██████	█	██████	██████	Burlington, VT	128	████	██████	██████
██████	█	██████	██████	Hutchinson, KS	129	████	██████	██████
██████	█	██████	██████	Hutchinson, KS	129	████	██████	██████
██████	█	██████	██████	Bowie, TX	130	████	██████	██████
██████	█	██████	██████	Salina, KS	131	████	██████	██████
██████	█	██████	██████	Hawaii, HI	132	████	██████	██████
██████	█	██████	██████	Hawaii, HI	132	████	██████	██████
██████	█	██████	██████	Casper, WY	133	████	██████	██████

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Call Sign	Channel Group	Lease	License / Lease Rights Holder	Center Market	Rank	MHz	2010 POPs	MHz POPs (2010)
██████	█	█	██████	Enid, OK	134	█	██████	██████
██████	█	█	██████	Ada, OK	135	█	██████	██████
██████	█	█	██████	Lake Havasu City, AZ	136	█	██████	██████
██████	█	██████	██████	Montpelier, VT	137	█	██████	██████
██████	█	█	██████	Emporia, KS	138	█	██████	██████
██████	█	█	██████	Garden City, KS	139	█	██████	██████
██████	█	█	██████	Globe, AZ	140	█	██████	██████
██████	█	█	██████	Great Bend, KS	141	█	██████	██████
██████	█	█	██████	Key West, FL	142	█	██████	██████
██████	█	█	██████	Hays, KS	143	█	██████	██████
██████	█	██████	██████	Newport, VT	144	█	██████	██████
██████	█	██████	██████	Newport, VT	144	█	██████	██████
██████	█	██████	██████	Newport, VT	144	█	██████	██████
██████	█	█	██████	Islamorada, FL	145	█	██████	██████
██████	█	█	██████	La Junta, CO	146	█	██████	██████

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Table 2: Top 5 License and Lease Holders Per Market Summary

Market Rank*	Center Markets	Total MHz	Total MHz POPs	Average POPs
1	New York City, NY			
2	Chicago, IL			
3	Houston, TX			
4	Philadelphia, PA			
5	Washington, D.C. + Baltimore, MD			
6	San Francisco, CA			
7	Seattle, WA			
8	Irvine, CA			
9	Phoenix, AZ			
10	Minneapolis, MN			
Subtotal Top 10 Markets (Avg MHz)				
11	Long Island, NY			
12	Dallas, TX			
13	Denver, CO			
14	Pittsburgh, PA			
15	St. Louis, MO			
16	Fort Worth, TX			
17	Sacramento, CA			
18	San Juan, PR			
19	Hartford, CT			
20	Las Vegas, NV			
Subtotal Markets Ranked 11-20 (Avg MHz)				
21	Portland, OR			
22	Milwaukee, WI			
23	San Antonio, TX			
24	Cincinnati, OH			
25	Orlando, FL			
26	Columbus, OH			
27	Providence, RI			
28	Norfolk, VA			
29	Kansas City, MO			
30	Charlotte, NC			
Subtotal Markets Ranked 21-30 (Avg MHz)				

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Market Rank*	Center Markets	Total MHz	Total MHz POPs	Average POPs
31	Lancaster, PA			
32	Salt Lake City, UT			
33	Raleigh, NC			
34	Austin, TX			
35	San Diego, CA			
36	Tampa, FL			
37	Nashville, TN			
38	Harrisburg, PA			
39	Modesto, CA			
40	Dayton, OH			
41	Oklahoma City, OK			
42	Buffalo, NY			
43	Memphis, TN			
44	Poughkeepsie, NY			
45	Grand Rapids, MI			
46	San Bernardino, CA			
47	Indianapolis, IN			
48	Rochester, NY			
49	Fresno, CA			
50	New Orleans, LA			
51	Greenville, SC			
52	Tucson, AZ			
53	Honolulu, HI			
54	Bayville, NJ			
55	Jacksonville, FL			
56	Arecibo, PR			
57	Albany, NY			
58	Tulsa, OK			
59	El Paso, TX			
60	Toledo, OH			
61	Youngstown, OH			
62	Syracuse, NY			
63	Melbourne, FL			

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Market Rank*	Center Markets	Total MHz	Total MHz POPs	Average POPs
64	Albuquerque, NM			
65	Saginaw, MI			
66	Madison, WI			
67	South Bend, IN			
68	Lansing, MI			
69	Colorado Springs, CO			
70	Hagerstown, MD			
71	Atlantic City, NJ			
72	Little Rock, AR			
73	Des Moines, IA			
74	Spokane, WA			
75	Fort Wayne, IN			
76	Boise, ID			
77	Mobile, AL			
78	Port St. Lucie			
79	Fort Myers, FL			
80	Santa Rosa, CA			
81	Pensacola, FL			
82	Palm Springs, CA			
83	Davenport, IA			
84	Killeen, TX			
85	Corpus Christi, TX			
86	Ocala, FL			
87	Omaha, NE			
88	Altoona, PA			
89	Bloomington, IN			
90	Sarasota, FL			
91	Utica, NY			
92	Mayaguez, PR			
93	Fajardo, PR			
94	Rochester, MN			
95	Mandeville, LA			
96	Waterloo, IA			

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Market Rank*	Center Markets	Total MHz	Total MHz POPs	Average POPs
97	Richland, WA			
98	Anchorage, AL			
99	Urbana, IL			
100	Waco, TX			
Subtotal Markets Ranked 31-100 (Avg MHz)				
Grand Total				

*Note: Rankings are based on the Average POPs of the Top 5 Licensee/Lessee Holdings, not by Top 100 markets by size

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Table 3: Spectrum Held in Top 30 BTAs

Estimated Holdings of Top 5 Holders in the Top 30 Markets - Center City Rankings

Market Rank*	BTA Number	Market	MHz
1	321	New York, NY	
2	262	Los Angeles, CA**	
3	78	Chicago, IL	
4	404	San Francisco, CA	
5	101	Dallas / Fort Worth, TX	
6	196	Houston, TX	
7	346	Philadelphia, PA	
8	461	Washington, DC	
9	24	Atlanta, GA	
10	347	Phoenix, AZ	
11	112	Detroit, MI	
12	51	Boston, MA	
13	293	Miami, FL	
14	413	Seattle, WA	
15	298	Minneapolis, MN	
16	110	Denver, CO	
17	440	Tampa, FL	
18	402	San Diego, CA	
19	394	St. Louis, MO	
20	84	Cleveland, OH	
21	74	Charlotte, NC	
22	29	Baltimore, MD	
23	358	Portland, OR	
24	401	San Antonio, TX	
25	336	Orlando, FL	
26	389	Sacramento, CA	
27	488	San Juan, PR	
28	245	Las Vegas, NV	
29	350	Pittsburgh, PA	
30	226	Kansas City, MO	

* Ranked by POPs in BTA

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