

**Before the  
Federal Communications Commission  
Washington, D.C. 20554**

In the Matter of	)	
	)	
Expanding Flexible Use in Mid-Band Spectrum	)	GN Docket No. 17-183
Between 3.7 and 24 GHz	)	
	)	

**COMMENTS OF FEDERATED WIRELESS, INC.**

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**I. INTRODUCTION AND SUMMARY**

Federated Wireless, Inc. (“Federated Wireless”), an innovator in the field of new spectrum management tools, such as the Spectrum Access System (“SAS”) that will soon manage dense shared use in the Citizens Broadband Radio Service (“CBRS”), offers these comments in response to the Notice of Inquiry (“NOI”) issued by the Federal Communications Commission (“Commission”) in the above-captioned proceeding.<sup>1</sup> Federated Wireless commends the Commission on taking this crucial first step toward enabling flexible use of the valuable mid-band spectrum between 3.7 and 24 GHz. In response to the Commission’s inquiry on how best to maximize this flexible use and its attendant benefits, Federated Wireless urges the Commission to expeditiously move to leverage SAS technology to enable shared use of the mid-band spectrum in the near term, as doing so will best serve the Commission’s goal of “establishing comprehensive, sound, and flexible spectrum policies, enabling innovations and investment to keep pace with technological advances, and maintaining U.S. leadership in deployment of next-generation services in the long term.”<sup>2</sup>

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<sup>1</sup> See *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, GN Docket No. 17-183, Notice of Inquiry, FCC 17-104 (2017).

<sup>2</sup> *Id.* at ¶ 1.

## **II. SHARED USE, ENABLED BY DYNAMIC SPECTRUM SHARING TECHNOLOGIES, IS THE BEST AND FASTEST PATH TO ENABLING FLEXIBLE USE OF THE MID-BAND SPECTRUM.**

New spectrum management techniques, first leveraged for the CBRS, can bring the revolutionary effects of spectrum sensing and SASs to other bands, including the mid-band spectrum. As the Commission has previously noted, “[d]ynamic spectrum access radios, as well as the new spectrum management techniques that they can enable, hold great promise as we seek to use our nation’s available spectrum resources more intensively and efficiently.”<sup>3</sup> By leveraging these technologies to identify and allocate spectrum that is not in use, and is therefore available in a particular area for some period of time, SASs are able to ensure that these valuable mid-band spectrum resources do not go underutilized at a time when bandwidth demands are growing exponentially. Federated Wireless agrees with the Commission that “[e]nsuring that we can take advantage of these improved efficiencies will be critical as we address a looming spectrum crisis, and can lead to increased spectrum value that spurs additional investment and innovation that can benefit American consumers.”<sup>4</sup> Federated Wireless thus urges the Commission in this proceeding to exploit SAS-like technologies to enable flexible use in the mid-band spectrum, as SAS-enabled sharing: (1) is readily extensible to 3.7-4.2 GHz and other mid-band spectrum; (2) holds significant advantages over legacy spectrum management approaches in terms of both density of spectrum utilization and time to market; allows transitions in spectrum use to occur at the pace of industry; and (4) provides significant flexibility in terms of the licensing scheme employed to authorize service in a particular band.

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<sup>3</sup> *Promoting More Efficient Use of Spectrum through Dynamic Spectrum Use Technologies*, ET Docket 10-237, Notice of Inquiry, FCC 10-198, at para. 16 (2010).

<sup>4</sup> *Id.*

**A. Extending the SAS-Enabled Sharing Framework from the CBRS Is the Most Expeditious, Efficient, and Effective Way to Promote Flexible Use of the 3.7-4.2 GHz Band.**

In the NOI, the Commission sought comment on how best to promote flexible use of the 3.7-4.2 GHz band, which is currently intensively used by Fixed Satellite Service (“FSS”) operators for the delivery of video and audio content and backhaul of voice and data traffic throughout the country.<sup>5</sup> In doing so, the Commission specifically asked whether the SAS-enabled sharing framework adopted for the CBRS could be extended to the 3.7-4.2 GHz band.<sup>6</sup>

Not only is the SAS-supported sharing framework in CBRS readily extensible to 3.7-4.2 GHz, it is the best—and only—path to enabling flexible fixed and mobile use of the band by the end of this decade. In establishing the three-tier CBRS framework, in which FSS interests operating in the extended C-band in the same manner in which they operate in the conventional C-band are afforded incumbent protections, the Commission has already evaluated and determined the protection criteria needed to enable flexible co-channel terrestrial use of C-band FSS spectrum.<sup>7</sup> To enforce these protections while simultaneously enabling the densest possible flexible use of the CBRS spectrum, the service relies on the SAS’s dynamic frequency assignment and interference modeling capabilities.<sup>8</sup> These interference protection obligations have now been incorporated into the CBRS SASs, and are being extensively tested and validated in the Commission’s SAS administrator certification process.<sup>9</sup> The final certification of SAS administrators is expected to be complete by the end of this year, clearing the way for commercial launch of CBRS operations.

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<sup>5</sup> *Id.* at ¶ 16. While FSS is the primary incumbent use of the 3.7-4.2 GHz band, it is also lightly used by Fixed Service (“FS”) microwave link operators.

<sup>6</sup> *Id.* at ¶ 22.

<sup>7</sup> *See* 47 C.F.R. § 96.17.

<sup>8</sup> *See id.* § 96.53(h).

<sup>9</sup> *See Wireless Telecommunications Bureau and Office of Engineering and Technology Establish Procedure and Deadline for Filing Spectrum Access System (SAS) Administrator(s) and Environmental Sensing Capability (ESC) Operator(s) Applications*, GN Docket No. 15-319, Public Notice, DA 15-1426 (WTB/OET 2015); *Wireless Telecommunications Bureau and Office of Engineering and*

Moreover, no modifications to the SAS-administered FSS protections in the CBRS are needed to extend a CBRS-like framework to 3.7-4.2 GHz. Instead, the SAS would simply need to access the IBFS database records, or a similar database with the necessary technical information on incumbent FSS systems, in order to obtain “the geographic locations and configuration of protected FSS locations” operating at 3.7-4.2 GHz,<sup>10</sup> and enforce the Commission’s FSS protections accordingly. Similarly, the SAS-enabled CBRS framework accounts for existing fixed wireless incumbent operations and provides protections for those licensees as they transition to the newly implemented flexible use rules for the band.<sup>11</sup> Such grandfathering and transitioning could readily be applied to the relatively limited incumbent FS use of the 3.7-4.2 GHz band.

In view of the fact that the Commission has already determined the protections needed to enable flexible use that coexists with C-band FSS incumbents, and has at its disposal a SAS designed to enforce those protections and effectuate shared use that will be tested, certified, and commercially available in the coming months, it is clear that SAS-enabled sharing is the most effective and the most efficient path to promoting flexible use of the 3.7-4.2 GHz band. The Commission should therefore promptly initiate a proceeding to do so, which will allow this valuable spectrum to be brought to market for the densest possible use at the earliest opportunity.

**B. Dynamic Sharing Technologies Are the Future of Spectrum Management, and the Use of Legacy Approaches Will Needlessly Restrict Utilization of Critically Important Spectrum.**

Whereas SAS-enabled sharing will make available the 3.7-4.2 GHz spectrum for innovative uses at the earliest opportunity, conventional spectrum management and transition approaches are wholly insufficient for providing access to such spectrum as expeditiously as it is needed. A

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*Technology Conditionally Approve Seven Spectrum Access System Administrators for the 3.5 GHz Band*, GN Docket No. 15-319, Public Notice, DA 16-1426 (WTB/OET 2016).

<sup>10</sup> 47 C.F.R. § 96.55(a).

<sup>11</sup> *Id.* § 96.21.

conventional “clear and auction” approach to the 3.7-4.2 GHz band will only serve to ensure that 5G services are not deployed in the band before the end of the decade. While it is important that the Commission and industry have accurate information as to the number of incumbents operating in a band and the intensiveness of their use,<sup>12</sup> that inquiry and the debate it is likely to generate is irrelevant to the fundamental issue with a “clear and auction” approach in this case. Regardless of the precise number, there are incumbents in the 3.7-4.2 GHz band, making use of the spectrum for purposes valuable to consumers such as the delivery of video and audio content to cable head ends and radio broadcasters. Relocating them will be disruptive, and will require a time-consuming inquiry and proceeding to identify and reallocate sufficient spectrum to support these operations. Relocating them to new spectrum, with the accompanying need to retrofit or replace their earth stations to operate in the new bands, will also come at significant cost. In contrast, SAS-enabled sharing allows the incumbents to remain in place, protected from harmful interference and without disruption to their current operations, while flexible terrestrial use of the band can commence in the very near term.

Other spectrum transition approaches, such as incentive auctions, coordination portals, and commercially negotiated relocation, similarly fall short of the need to make the 3.7-4.2 GHz band available for flexible use at the earliest opportunity. Despite the success of the broadcast incentive auction in identifying broadcasters willing to relocate to open up 600 MHz spectrum for commercial wireless operations, those operations cannot commence on a significant scale until the broadcasters complete the 39-month post-auction transition to new channels, a process scheduled to complete no earlier than July 2020. In contrast, in the CBRS—which arose out of a proceeding that, like the incentive auction, commenced in 2012—commercial operations will commence shortly after SAS certification by the end of this year.

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<sup>12</sup> See NOI at ¶ 12.

The use of a coordination portal similar that used in AWS-3 or another traditional coordination approach will likewise introduce unnecessary delay and other obstacles to the deployment of flexible uses in the 3.7-4.2 GHz band. In the extended C-band, the Commission has previously found that FSS sites require a 150-kilometer protection zone and that no wireless operations may take place within those protection zones unless first coordinated with the FSS licensee.<sup>13</sup> In the context of the CBRS, the Commission found those protection zones to be “excessively large, overly simplistic, and inefficient *given the capabilities of SASs to predict realistic path loss.*”<sup>14</sup> Absent the SAS capabilities on which the Commission expressly relied in authorizing CBRS operations within 150 km of an FSS earth station, a coordination portal or similar approach would likely require a reversion to the default protection zones. In view of the vastly larger number of conventional C-band earth stations than those operating in the extended C-band, this would leave little to no spectrum for flexible use until prospective wireless operators negotiated coordination agreements with incumbents, a time-consuming incremental process that would impose significant burdens on both wireless and FSS licensees.

Finally, commercial relocation approaches, such as the process employed in the Commission’s Emerging Technologies proceeding, will not ensure expeditious—let alone successful—relocation of incumbents in the band. As an initial matter, relocation of incumbents requires the identification and allocation of the spectrum to which the incumbents will relocate. In the Emerging Technologies proceeding, the Commission identified the spectrum to which microwave incumbents vacating the spectrum reallocated for PCS and AWS, finding that the newly assigned spectrum could sufficiently support the incumbents’ operations.<sup>15</sup> In this case, no such

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<sup>13</sup> See 47 C.F.R. § 90.1331.

<sup>14</sup> 3.5 GHz Order at ¶ 288.

<sup>15</sup> *Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies*, ET Docket No. 92-9, Second Report and Order, 8 FCC Rcd 6495 (1993).



identification and reallocation has been initiated, and it is entirely possible that there is no near-term viable alternative for the incumbents to continue their operations. Conducting such an inquiry would be time-consuming and disruptive, and would unnecessarily delay the deployment of flexible use services where SAS technology could enable such operations in the very near term. It is thus clear that the Commission should adopt SAS-enabled sharing in the 3.7-4.2 GHz band to promote flexible use in the band at the earliest opportunity, regardless of the Commission's ultimate decision as to the relocation of incumbents.

**C. Spectrum Sharing and Dynamic Sharing Technologies Are Fundamental to US Leadership in the Global 5G Marketplace.**

At the recent Mobile World Congress Americas, Chairman Pai declared that “Our goals are clear: to make sure the U.S. continues to lead in 5G and to enable wireless consumers to benefit from these technologies sooner rather than later.”<sup>16</sup> As parties have observed in other proceedings the 3 to 4 GHz spectrum region is ideally suited for introduction of 5G and activities are underway in China, the European Union, (“EU”), an EU/Brazil joint partnership, Japan, Russia, and South Korea are all working to develop 5G in the 3 GHz band.<sup>17</sup> There is no doubt that the Commission must act swiftly to maintain U.S. leadership in the global 5G race, but such action does not need to pit important industries against each other. Spectrum sharing is the obvious solution, as it will enable the near-term allocation of 3.7-4.2 GHz and other mid-band spectrum for flexible use while protecting the ongoing and important operations of incumbents. This, in turn, will allow the continued development of 5G standards and equipment for the band while avoiding delays that would otherwise be created by legacy spectrum management and transition approaches, as incumbents would first have to be relocated or negotiate coordination agreements one-by-one with

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<sup>16</sup> Remarks of FCC Chairman Ajit Pai at Mobile World Congress Americas, San Francisco, CA (Sep. 12, 2017), available at [http://transition.fcc.gov/Daily\\_Releases/Daily\\_Business/2017/db0912/DOC-346666A1.pdf](http://transition.fcc.gov/Daily_Releases/Daily_Business/2017/db0912/DOC-346666A1.pdf).

<sup>17</sup> See, e.g., CTIA, Petition for Rulemaking to Amend the Commission's Rules Regarding the Citizens Broadband Radio Service in the 3550-3700 MHz Band, RM-11788 (filed June 16, 2017).

new entrants. Spectrum sharing is thus crucial to enabling operations in the band to reach scale at the rate needed for the U.S. to maintain its leadership position in the race to 5G.

Moreover, considering that shared spectrum is fundamental to enabling 5G, it should come as no surprise that dynamic sharing technologies are already contemplated in 5G technical standards development. Qualcomm has recently noted that its 5G New Radio (“NR”) will be a platform for shared spectrum and the applications it supports. As Qualcomm explains,

Access to shared and unlicensed spectrum will extend 5G in multiple dimensions - such as more capacity, higher spectrum utilization, new deployment scenarios. It will benefit mobile operators with licensed spectrum but also opens the doors to those without licensed spectrum – such as cable operators, enterprise or IoT verticals – to take advantage of the 5G New Radio (5G NR) family of technologies. 5G NR is designed to natively support all spectrum types and, through forward compatibility, has the flexibility to take advantage of new spectrum sharing paradigms. This creates opportunities for new innovation to take spectrum sharing to the next level in 5G.<sup>18</sup>

Work on 5G NR is already underway and 3GPP has agreed on an accelerated schedule that will enable large-scale trials and deployments of 5G as early as 2019.<sup>19</sup> As Qualcomm notes. “5G will proliferate around the world more broadly and more rapidly if all spectrum types can be used... to support more uses and deployments models so that many more entities will be able to enjoy the benefits of 5G in a much broader 5G ecosystem.”<sup>20</sup>

Through the work of the Commission and companies representing more than \$1 trillion of market capitalization,<sup>21</sup> the CBRS and the SAS and ESC technologies that enable its revolutionary dynamic sharing framework have established the U.S. as the global leader in dynamic spectrum sharing. Maintaining this U.S. leadership is essential, and regulators in other countries are closely

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<sup>18</sup> Qualcomm, 5G Spectrum Sharing, *available at* <https://www.qualcomm.com/invention/technologies/5g-nr/spectrum-sharing>.

<sup>19</sup> Qualcomm, 3GPP Starts Study on 5G NR Spectrum Sharing (Apr. 26, 2017), *available at* <https://www.qualcomm.com/news/onq/2017/04/26/3gpp-starts-study-5g-nr-spectrum-sharing>.

<sup>20</sup> *Id.*

<sup>21</sup> The estimated combined market capitalization of member companies in the Wireless Innovation Forum and CBRS Alliance.

watching CBRS developments as they consider how leverage these technologies to maximize the density and efficiency of spectrum utilization within their jurisdictions.<sup>22</sup> The Commission should therefore act expeditiously to leverage dynamic spectrum sharing technologies in the 3.7-4.2 GHz band and other mid-band spectrum to ensure that the U.S. remains the leader in innovative spectrum management frameworks as the deployment of 5G technologies—and their well-known, significant spectrum demands—nears. Failure to do so would forfeit the U.S. advantage in dynamic sharing at a time when solutions to increase the efficiency of spectrum utilization are most needed and put our 5G leadership at risk.

**D. SAS Technology Enables Various Uses of Spectrum to Transition Into and Out of a Band at the Pace of Industry and Ensures Dense Shared Use in the Interim.**

In addition to the advantages of SAS technology in making spectrum available for flexible use in the most expeditious manner possible, the SAS also eliminates the need to predetermine how and when incumbents move out of the band. Instead, these transitions can take place at the pace of industry and technological innovations.

Leveraging SAS or similar technologies to enable dense, intensive, flexible use in mid-band spectrum thus provides the Commission the flexibility to adopt relatively minimal, baseline technical rules and rely on industry standards and the capabilities of dynamic sharing solutions to manage disparate uses between incumbents and new users of a particular band. In fact, in a recent blog post on mid-band spectrum, Commissioner O’Rielly made the case for adoption of a SAS in the 3.7-4.2 GHz band. “In the case of the 3.7 to 4.2 GHz licensees, it’s easy to imagine that a suitable market-based arrangement could be fashioned. To the extent that can’t be achieved, the Commission could adopt innovative sharing techniques and very narrow protection zones for *legitimate* C-Band earth

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<sup>22</sup> Federated Wireless has already addressed inquiries, participated in workshops, or responded to formal spectrum sharing related consultations with regulators representing more than 15 countries.

stations or fixed links in operation. Such protection zones would only be as large as is needed to ensure that there is no actual harmful interference to the incumbent.”<sup>23</sup>

In addition, uses of the spectrum will eventually transition to new technologies as use cases and consumer demands evolve and the market responds accordingly. Indeed, this is already the case at 3.7-4.2 GHz, as Commissioner O’Rielly has observed. “One element that makes this idea so attractive is that satellite services in the 3.7 to 4.2 GHz band are a bit past their prime.”<sup>24</sup> This is the case for several reasons. As with all satellites, the C-band satellites used by past and current incumbents have a finite lifespan. In addition, video delivery has moved to alternate facilities, such as the Ku- and Ka-bands, as well as wireline and wireless networks. By virtue of the fact that they use the C-band “in conjunction with commercial geostationary satellites,”<sup>25</sup> federal C-band users have similarly been moving their operations to alternative facilities.

As demonstrated by the ongoing evolution in the uses of the 3.7-4.2 GHz spectrum, the Commission should not attempt to prognosticate what future spectrum uses will be, and instead should adopt a flexible regulatory framework that allows dynamic sharing. With flexible use and baseline technical rules in place, shared spectrum technologies like the SAS can both manage competing uses in the near term and the transition to new use cases as they emerge, all while minimizing interference and protecting incumbents as needed. In contrast, more traditional spectrum approaches such as “clear and auction” or commercial negotiation create incentives for incumbents to steadfastly hold onto their spectrum regardless of the intensiveness of their use in hopes of a potential windfall. SAS-enabled sharing removes this incentive and, in so doing, may

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<sup>23</sup> Michael O’Rielly, Commissioner, *A Mid-Band Spectrum Win in the Making*, FCC BLOG (July 10, 2017), available at <https://www.fcc.gov/news-events/blog/2017/07/10/mid-band-spectrum-win-making>.

<sup>24</sup> *Id.*

<sup>25</sup> National Telecommunications and Information Administration, Federal Government Spectrum Compendium – 3700-4200 MHz, available at [https://www.ntia.doc.gov/files/ntia/publications/compendium/3700.00-4200.00\\_01DEC15.pdf](https://www.ntia.doc.gov/files/ntia/publications/compendium/3700.00-4200.00_01DEC15.pdf).

further accelerate the availability of spectrum for new and innovative uses to meet the exploding demand for wireless data services.

**E. SAS Technology Is Compatible with Any Licensing Regime the Commission Might Apply to the Mid-Band Spectrum.**

As the Commission considers how best to promote flexible use of the mid-band spectrum, which supports a wide array of incumbent satellite and terrestrial uses, it should take advantage of the fact that SAS technology has the capability to support any licensing framework the Commission may elect for a particular band. In the case of the 3.7-4.2 GHz band, for instance, the use of a SAS to enable shared use and incumbent protection in the near term does not foreclose on the possible auction and assignment of exclusive use licenses in the band. While SAS technology has initially been applied to the permanent, three-tiered sharing framework of the CBRS, that application is driven by the characteristics of the CBRS spectrum and its current uses. Unlike the CBRS spectrum, there is no 3.7-4.2 GHz federal incumbent which intends to remain in the band and which uses the band in a dynamic and variable manner that impacts the availability of spectrum for non-federal use, inhibiting the Commission's ability to issue exclusive use licenses. In addition, an auction of exclusive use 3.7-4.2 GHz licenses could take place at any time after the initiation of SAS-enabled shared use, as the Commission determines whether and how to relocate incumbent uses. Nor would there need to be a single auction, but instead SAS-enabled sharing could support multiple auctions as incumbents migrate out of the band.

Moreover, unlicensed use, on which the Commission seeks comment with respect to the 6 GHz band, is fundamentally a form of shared use enabled by the Commission's Part 15 rules. Each of the approaches on which the NOI seeks comment with respect to enabling unlicensed use in the 6 GHz band is fundamentally a coordination mechanism. Each of these is characterized by its level of sophistication and appropriateness to the complexity of the interference problem it is intended to manage. Given the widespread use of 6 GHz band by incumbents, a SAS or similar dynamic

sharing solution—which leverages the most advanced cloud computing and machine learning capabilities available to maximize interference mitigation and spectrum utilization—is the best approach to enabling unlicensed access in this band. In light of this intensive incumbent use of the band, in fact, to enable anything approaching significant unlicensed use the Commission will eventually be forced to adopt a mechanism to permit unlicensed users to opportunistically operate where and when an incumbent is not transmitting. As noted above, a SAS or similar technology is best suited to this purpose. Once this dynamic coordination tool is in place, with priority rights for incumbents and opportunistic use available to unlicensed users, this spectrum begins to bear a striking similarity to the General Authorized Access tier of the CBRS. The Commission should leverage the capability of the SAS to support spectrum access in accordance with any licensing regime the Commission might deem appropriate to a particular band—whether exclusive use, CBRS-like tiered sharing, or unlicensed use—as it seeks to establish comprehensive, sound, and flexible spectrum policies in the mid-band spectrum.

### III. CONCLUSION

Federated Wireless commends the Commission on its initiation of this proceeding to determine how best to promote flexible use in the mid-band spectrum between 3.7 and 24 GHz. Federated Wireless stands ready to aid the Commission in pursuit of this goal, and urges the Commission to leverage SAS technology in this pursuit, as doing so is the best and most efficient means to enable flexible use, eliminates the shortcomings of traditional spectrum management approaches, provides a mechanism for the transition of new and legacy uses into and out of particular bands, and offers the Commission the flexibility to apply the licensing regime best suited to each band.

Respectfully submitted,

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