I. Introduction and Background

Rajant Corporation (“Rajant”) submits these comments in response to the Commission’s Second Further Notice of Proposed Rulemaking in the 3.5 GHz proceeding.1 Rajant develops networks for industry, transit, public safety and military that harness both unlicensed and licensed spectrum for a more redundant, robust customer experience. In public safety, military and critical infrastructure markets, Rajant provides nodes that combine unlicensed frequencies with bands allocated to services in its customers’ sector, thereby maximizing the efficient use of spectrum, and promoting the evolution of sharing technologies. Rajant holds a 3650 MHz license today through November 2021 and is working with its partners to deploy micro-targeted, highly-customized broadband networks for multi-media use over small cells, consistent with the

goals of the FCC’s proceeding. Rajant has consistently innovated in unlicensed technology and plans to develop equipment and products that will comply with the Part 96 rules, once the Spectrum Access System (SAS) and Environmental Sensing Capability (ESC) discussed in the Report and Order are operational. Rajant has developed a geographic coordination tool for the 3.6 GHz range that will facilitate its partners’ access to this Innovation Band.

While the Commission’s R&O adopted a complete set of rules and policies, the Commission noted that there “remain a few focused issues that would benefit from further record development.” The Second FNPRM seeks comment on three issues: (1) how to define “use” of Priority Access License (PAL) frequencies, e.g., in engineering or economic terms; (2) whether and how to facilitate secondary markets for the PAL spectrum; and (3) how to optimize both the protection of grandfathered Fixed Satellite Service (“FSS”) and efficient use of the band for mobile broadband. In these comments, Rajant offers insight based on its current experimentation in the 3650-3670 MHz band to address the second and third issues: implementing secondary markets in PAL and optimizing protection for grandfathered fixed satellite service.

II. Implementing Secondary Markets in Priority Access Licenses

The Commission seeks comment on “the implications of applying [its] secondary market rules to the 3.5 GHz Band ecosystem.” Given that the FCC’s goals for the 3.5 GHz band of

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2 See, e.g., R&O at 3962-63, ¶ 7.
3 Second FNPRM at 4081 ¶ 418.
4 Id. at 4081-85 ¶¶ 419-430.
5 Id. at 4085-87 ¶¶ 431-435.
6 Id. at 4087-4089 ¶¶ 436-442.
7 Id. at 4086 ¶ 434.
spectrum are technological flexibility, administration simplicity, and light-touch regulation, it should apply a version of its secondary market rules. However, the FCC should allow secondary markets through disaggregation and partitioning of PALs through notice only, and not require prior approval through application to the FCC. Rajant agrees with WISPA and Spectrum Bridge Inc. that the FCC will create a more fluid market if it does not require prior approval in advance of disaggregation or partitioning. Consistent with the goals for this Innovation Band, the FCC can innovate in its secondary market rules by requiring notice only. By incorporating a notice requirement, the FCC would retain the authority to invalidate the transaction if it violated any FCC rules. A more light-touch, simple rule would improve liquidity in this band, and is appropriate for a band where general authorized access is allowed through the 150 MHz in any event.

In light of the nature of the PAL—short term, micro area—Rajant anticipates that there should be a fairly liquid market inherently, given the three year term and the relatively small service area. The census block area will encourage service to particular industrial or commercial facilities or community centers. But to serve such facilities, which may straddle a census block, a provider may require some partition or disaggregation of an adjacent PAL to fully serve the intended site. For instance, Rajant is working with its partners to serve certain public stadiums. In another deployment in another band that could be served in the 3.6 GHz, Rajant is working with public transit authorities on fleet management and private multi-media communications. To better serve targeted areas, as opportunities arise such as extension of transit rail lines, new venues added, etc., licensees should be able to acquire or sub-lease additional 10 MHz blocks, or

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8 Id. at 4082 ¶ 423.
9 Id. at 4086 ¶ 434.
10 Id. at 4085 ¶ 432.
additional geographic areas, on fairly short order. A notice requirement would facilitate the ability for licensees to put that spectrum to commercial use in the most efficient manner. Rajant’s operations in the 20 MHz band of 3650-3670 MHz have revealed excellent data throughput, including BlueRay quality video, with 1 Megabit capability for mobile broadband, suggesting the value of an incremental 10 MHz block of spectrum in the band.

Today, Rajant’s customers for its 3.6 GHz license are its partners. As the SAS and ESC become available, those partners may wish to bid on a PAL to be licensees on their own. That option—to be a customer of an existing WISP licensee in the near-to-medium term, or to bid on a PAL directly—is a type of secondary market for the 3.6 GHz band that will inherently bring some market rationalization in terms of pricing, business models, etc.

For all the above reasons, for this Innovation Band which already has the promise to create a rational, fluid market, the FCC should allow secondary markets, but do so consistent with its goals for simplicity and flexibility, and require notice only of secondary spectrum transactions.

III. Optimizing Protection of Grandfathered Earth Stations

The Commission’s Second FNPRM raises questions about both in-band protection of FSS C-Band Earth Stations and of out-of-band protection regarding the 3650-3700 MHz band.

a. In-Band Protection

Regarding in-band protection of FSS in the 3650-3700 MHz band, Rajant notes that FSS is allocated both below 3650 MHz, in the 3500-3650 MHz frequency range, and above, at the 3700-4200 MHz range. In Rajant’s operations to date in the 3650-3700 MHz band, it has found the existing coordination requirements under Part 90 to be administratively simple. However, it
has found that the FCC’s lists of grandfathered earth stations provided for the purpose of Part 90\textsuperscript{11} are not necessarily current. Rajant therefore appreciates that the Commission’s new rules in Section 96.17 will require FSS earth station licensees requesting protection to register annually with the FCC.\textsuperscript{12} The same challenges with the currency of data regarding the incumbent government radar also exist. Rajant encourages the FCC to work with NTIA to ensure that contact and other public information for relevant radar operations is kept up to date. This will be particularly critical given the short license term of the PAL. With the small size of the PAL service area, the accuracy of radar information will also be critical to achieve an efficient market for this innovation band.

Rajant also believes, based on its own operations to date in the 3650-3670 MHz band, which comply with power limits applicable to Part 90 devices, that the Commission’s new rule in section 96.17(e) that allows a smaller exclusion zone than 150 km to be negotiated between operators of Citizens Broadband Radio Service Devices (CBSDs) and FSS earth stations will facilitate more efficient spectrum use in the band. One of Rajant’s current deployments is sited at large stadiums used for major sporting and entertainment events. In such a venue, the signal of the base and portable broadband devices at 3650 MHz ends when it hits the thick concrete walls and is significantly weakened by the substantial amount of metal in the stadium construction—akin to a giant “Farraday” cage. In such instances, CBSD users should be able to negotiate a much smaller coordination zone, and operate far closer to an FSS Earth station than the 150 km exclusion zone required today under the Part 90 rules.

For these same reasons, Rajant appreciates the work NTIA and its fellow agencies did to

\textsuperscript{11} See 47 C.F.R. § 90.1331.

\textsuperscript{12} R&O, Appendix A, § 96.17(d).
decrease the exclusion zones around incumbent radar at 3500 MHz and above. Such work will allow Rajant to serve additional stadiums, industrial sites, and other venues that today fall outside the larger exclusion zones.

b. **Out-of-Band Protection of C Band FSS Earth Stations**

Rajant appreciates that the Commission recognizes that the out-of-band emission limit of -40dBm/MHz may leave room for more optimization of spectrum use, particularly when CBSDs or End User Devices are operating far from the grandfathered Earth station. In its operations at 3650-3670 MHz, using spectrum analyzers to determine consistency with Part 90 rules, Rajant has observed the different signal propagation based on antenna gain. Rajant therefore supports a more fact-based approach to sharing spectrum with the incumbent FSS Earth stations.

c. **End User Devices**

Rajant currently operates mobile, highly-scalable broadband networks in a number of bands, with devices that leverage both unlicensed and licensed bands. Its deployments at 3.6 GHz can scale the number of portable units as well, to meet the customer’s needs, in a highly customizable configuration, consistent with the Commission’s goals for flexible, efficient use.

To protect FSS and government incumbents, both the new Part 96 and the current Part 90 rules require that mobile/portable End User devices may only operate if they can receive and decode an authorization signal sent by a fixed base station. In the case of the Part 96 rules, these fixed base stations are CBSDs. Part 96 requires End User Devices to include transmit power control (TPC) capability and the capability to limit their maximum EIRP in response to

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13 See R&O at 3961 ¶ 3.
14 Second FNPRM at 4089 ¶ 443.
15 See R&O, Appendix A, § 96.47; 47 C.F.R. § 90.1333.
16 R&O at 4034 ¶ 241.
instruction from their associated CBSDs. Rajant is currently experimenting with dynamic TPC capability. Given the cost and the technical challenge to extend battery life in a useable form factor, it is in the provider’s interest to use TPC to decrease power whenever possible. Rajant anticipates that the TPC requirement will be readily met in the band.

Rajant appreciates the Commission’s concern that the End User Devices may be situated within Line-of-Sight (LoS) or near-LoS propagation, with less propagation loss between the End User Device and the FSS Earth station than the propagation channel from the CBSD to the Earth station. However, this concern will be mitigated when the PAL is in an urban or suburban area with more path-loss clutter where the census block service area is very small. Moreover, in deployments with natural or man-made barriers like a below-ground mine, a transit tunnel, or a stadium, this LoS concern is even more mitigated. Rajant agrees with the Commission that assuming the worst-case LoS propagation could lead to unnecessarily large protection distances for incumbent Earth stations. Rajant recommends that CBSD users be allowed to provide the geographic coordinates of any industrial (non-consumer) deployments, including the farthest possible point of any End User Device, to the SAS. This is particularly easy to accomplish in sites like stadiums or other enclosed or geographically-bounded facilities.

The FCC asks for comment on “reasonable methods for ensuring that the mobility, location, and orientation of End User Devices are managed effectively to avoid excessive interference to in-band FSS earth stations, while avoiding a mandate for geo-location requirements on End user Devices.” Providing the geographic location of an industrial

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17 Id. at Appendix A, § 96.41(c)(2).
18 Second FNPRM at 4089 ¶ 442.
19 Id.
20 Id.
deployment to the SAS—as currently required by Part 96.39(c)—would optimize commercial use of the band, while removing the need for geolocation capability in each End User Device. While Rajant is not opposed to geolocation requirements in a 3.6 GHz End User Device, such a requirement would drain the battery of the device, and therefore add additional costs to operation in the Innovation Band. Unnecessary costs seem inconsistent with the FCC’s over-arching goals for efficient use of the band. For some of Rajant’s planned 3.6 GHz deployments—in enclosed stadiums, under-ground mass transit tunnels, etc.—GPS location data would be difficult to receive. While GPS simulators are available, to be administratively simple and allow for technical flexibility, geolocation should not be imposed on 3.6 GHz portable devices that will not be used by consumers, but instead are intended for industrial, public safety or commercial deployments in confined, managed sites.

In such sites, with industrial End Users that are employees or even machines, the CBSD user could provide in its initial registration with the SAS under Part 96.39(c) not just its geographic location, but also whether its End User Devices will be used by the general public as consumers. Non-consumer End User Devices would not require geolocation capability to be confined within the registered site location. In such managed sites, the CBSD, acting as a network administrator, would “beacon-off” any End User Device which was ported beyond the registered contours. For such non-consumer deployments, registered location would be sufficient, given the new rules’ 10 second “kill switch” requirement and the tamper-proof security requirements.

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22 R&O at 4033 ¶¶ 238-240; id. at Appendix A, § 96.39(g).
IV. Conclusion

Rajant commends the Commission on its innovation in spectrum management in the 3.5 GHz band. Through its own experimentation in the band, Rajant has found that innovative mobile broadband uses, through highly-customizable configurations, are possible, providing high-resolution video and broadband data. In its Report and Order, the FCC said the public interest would be served by maximizing the flexibility and utility of the 3.6 GHz band for the widest range of potential users. Rajant offerings in the band will expand the use cases beyond traditional Internet access to multi-media broadband provided over small-cells and portable devices. To enhance the utility of the band, Rajant recommends that the FCC allow secondary market transactions upon notice to the Commission, and that geolocation requirements not be imposed on End User Devices to be used with non-consumer CBSD registrations. Rajant also supports more fact-based propagation measurement tools to optimize both the protection of grandfathered FSS Earth stations and efficient use of the band for varied mobile broadband use.

Respectfully submitted,

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July 15, 2015

23 See R&O, Section III(b)(2)(b), 3982-84 ¶ 72; Second FNPRM at 4081 ¶ 419.