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

In the Matter of
Amendment of the Commission’s Rules with
Regard to Commercial Operations in the
3550-3650 MHz Band

GN Docket No. 12-354

REPLY COMMENTS OF GOOGLE INC.
ON THE PROPOSED REVISED FRAMEWORK

Austin C. Schlick
Director, Communications Law
Aparna Sridhar
Counsel
GOOGLE INC.
1101 New York Ave., NW, 2nd Floor
Washington, D.C. 20005

December 20, 2013

Paul Margie
S. Roberts Carter
WILTSHEIRE & GRANNIS LLP
1200 Eighteenth Street, NW
Washington, D.C. 20036
(202) 730-1300

Counsel for Google Inc.
TABLE OF CONTENTS

I. INTRODUCTION AND SUMMARY. ........................................................................................................ 1

II. THE COMMISSION SHOULD ADOPT THE PROPOSED THREE-TIER AUTHORIZATION FRAMEWORK. ...................................................................................................................... 1

III. THE COMMISSION SHOULD MAXIMIZE UTILIZATION OF THE 3.5 GHZ BAND BY ENABLING ROBUST SAS FUNCTIONALITY AND REQUIRING BAND-WIDE DEVICE OPERABILITY. ........ 6
    A. Robust Spectrum Access Systems Will Advance the Commission’s Goals. ........... 7
    B. FCC Rules Should Require Band-Wide Operability............................................... 9
    C. The FCC Should Adopt the Same Power Rules for All Operators. ....................... 10

IV. PRIORITY ACCESS LICENSE AREAS SHOULD BE HIGHLY LOCAL, AND BASED ON INTERFERENCE PROTECTION NEEDS RATHER THAN GEOGRAPHIC UNITS. ......................... 12

V. CONCLUSION.................................................................................................................................... 15
I. **INTRODUCTION AND SUMMARY.**

In its response to the Commission’s recent Public Notice, the Commission’s proposals for increasing use of the 3.5 GHz band and recommended a series of implementation steps that would further promote innovation, efficiency, and diversity. Some commenters, however, argued for rules that would limit innovation in the band. Google urges the Commission to reject those arguments, and maintain its commitment to use the 3.5 GHz proceeding to adopt rules that advance spectrum sharing and promote intensive use of this spectrum through evolutionary technologies. Specifically, Google recommends that the FCC: (1) adopt its proposed three-tier authorization framework; (2) enable robust Spectrum Access System (“SAS”) functionality and band-wide device operability; and (3) allow SASs to assign highly local Priority Access license areas based on actual interference protection needs, rather than arbitrary geographic areas.

II. **THE COMMISSION SHOULD ADOPT THE PROPOSED THREE-TIER AUTHORIZATION FRAMEWORK.**

Most parties agree that the foundation for coexistence in the 3.5 GHz band should be the three-tier access model described in the PCAST Spectrum Report and proposed in the Revised Framework. But a few commenters continue to urge the Commission to restrict certain uses in

---


the band by adopting a two-tier regime. The Commission should reject those arguments and move forward with its proposed three-tier framework, which provides the broad eligibility for operations in the Priority Access tier needed to maximize the utility of the band.

As Google has previously explained, a two-tier approach that accommodates only incumbents and Priority Access licensees incorrectly assumes that the highest and best use of commercial spectrum in the 3.5 GHz band is and always will be operations that rely on quality of service guarantees. The record shows that this is not true. Opportunistic access to spectrum—such as in the 2.4 GHz and 5 GHz bands—has driven innovation and created enormous economic value that would not have been realized under traditional licensed access models. For
example, the success of technologies such as Wi-Fi, RFID, and Bluetooth has depended on
access to spectrum bands that do not have high upfront deployment costs or other barriers to
entry. While the innovative licensing regime the FCC is considering for the Priority Access
portion of the 3.5 GHz band will reduce entry barriers compared to traditionally licensed bands,
barriers will still be too high for many users and applications. In contrast, the GAA tier will
enable users to access available spectrum simply by deploying equipment certified to operate
under the 3.5 GHz band rules. Therefore, as demonstrated by Microsoft, the New America
Foundation Open Technology Institute, and Public Knowledge, a two-tier approach that
accommodates only incumbents and Priority Access License ("PAL") holders in the 3.5 GHz
band would significantly limit consumer benefits.

GAA opportunities will also facilitate mobile data offload, improving the performance of
licensed carriers’ networks. Indeed, as the New America Foundation Open Technology Institute
and Public Knowledge have explained in detail, “the widespread availability of Wi-Fi operating
on unlicensed spectrum is the single most important factor in mitigating the ‘spectrum crunch.’
This is in part because, compared with licensed carriers, “individual consumers, businesses and

Google Reply Comments at 6-7. See also Spectrum Bridge PN Comments at 4, 7 (citing
benefits of providing a “healthy mix” of GAA and Priority Access spectrum).

7 Google Reply Comments at 7.

8 See, e.g., Microsoft PN Comments at 2; Google PN Comments at 3-5; OTI and PK PN
Comments at 6-9.

9 OTI and PK PN Comments at 6.
an array of non-carrier providers … are in a superior position to leverage the infrastructure … that is already deployed, typically on their own property.”

To be sure, some advocates of a two-tier model would allow GAA devices to operate in a subset of the 3550-3700 MHz band. Enabling opportunistic access by GAA devices throughout the band, though, will ensure that spectrum that is not being used by incumbents or Priority Access licensees can be put to productive use. In addition, enabling Priority Access and GAA use throughout the band will provide networks maximum flexibility to convert from Priority Access to GAA operation, or vice versa, as circumstances warrant. Finally, applying the three-tier access model to the entire band will ensure that manufacturers can realize economies of scale rather than having to create unique equipment for subparts of the 3.5 GHz band.

Contrary to the suggestions of some commenters, GAA operations will not pose a risk of interference to incumbents or Priority Access users. GAA networks will require permission from an SAS database to operate based on the determination that a particular frequency is available for the requested use at a particular location. For example, Qualcomm has observed that its proposed two-tier model “can prevent interference to and from incumbent government users in the 3.5 GHz band” because it “allows commercial licensees to operate within the interstices of the frequency band where and when government users are not using it, and to quickly vacate the spectrum so incumbents can successfully operate.”

10 Id. at 9 (emphasis removed).
11 See, e.g., Nokia PN Comments at 11-12; T-Mobile PN Comments at 11.
12 See, e.g., Nokia PN Comments at 11, 13; Verizon PN Comments at 6-7.
13 See OTI and PK PN Comments at 13.
14 Qualcomm PN Comments at 4-5.
Access licensees, GAA networks would operate subject to requirements to transmit only on frequencies authorized by an SAS, and to vacate if and when permission to operate is revoked.

In other words, GAA networks would not operate autonomously, as many unlicensed networks do today, but rather in a manner similar to TV White Spaces devices. In the TV White Spaces proceeding, the Commission acknowledged that the interference consequences could be “severe” if devices did not operate in accordance with the rules. But instead of denying opportunistic access to the TV band, the Commission required databases and devices to “incorporate reasonable and reliable security measures to minimize the possibility that TV bands devices will operate on occupied channels and cause interference to licensed services.”

The Commission should likewise establish reasonable security requirements to ensure that 3.5 GHz band devices are operating consistent with the parameters provided by SASs. But the Commission’s security rules should not treat Priority Access and GAA devices differently, as some commenters suggest. All devices—those used by Priority Access licensees and GAA operators alike—will operate on networks based on spectrum availability determined by an SAS. All devices must protect incumbents as well as Priority Access networks. There is no record support for the proposition that GAA devices categorically pose more risk than Priority Access devices in this environment, so both classes of users should be subject to the same security obligations.

15 See id; WISPA PN Comments at 9.
17 Id.
19 See Verizon PN Comments at 6-7.
Likewise, the Commission should reject calls to create an access model that wholly eliminates the Priority Access tier, or imposes substantial eligibility restrictions on access to this tier.\textsuperscript{20} As Alcatel-Lucent, AT&T, the Consumer Electronics Association, Nokia, and PCIA explain, doing so would preclude investment in the 3.5 GHz band by commercial operators and other networks that rely on quality of service guarantees, greatly reducing the utility of the spectrum.\textsuperscript{21}

The Commission thus should adopt a three-tier framework that accommodates both Priority Access and GAA use of the band, allowing the market to determine the optimal mix of uses for each access model in each geographic area.\textsuperscript{22}

\textbf{III. THE COMMISSION SHOULD MAXIMIZE UTILIZATION OF THE 3.5 GHz BAND BY ENABLING ROBUST SAS FUNCTIONALITY AND REQUIRING BAND-WIDE DEVICE OPERABILITY.}

The Commission wisely proposes to promote productive spectrum use in the 3.5 GHz band by “leveraging the unique characteristics of small cells and the capabilities of modern database technologies to ensure that the 3.5 GHz Band is used intensively for a wide variety of

\textsuperscript{20} See, \textit{e.g.}, Comments of KanOkla Communications, Inc. at 3-4, GN Docket No. 12-354 (filed Dec. 5, 2013) (FCC should adopt a two-tier model with incumbents and GAA uses, but not priority access); Comments of the Utilities Telecom Counsel at 2-4, GN Docket No. 12-354 (filed Dec. 5, 2013) (FCC should restrict Priority Access tier to “critical access” uses). \textit{See also} Microsoft Comments at 6 (Priority Access should be limited to “mission critical” uses, but Commission could consider expanding eligibility subject to limitations to promote competition).

\textsuperscript{21} See, \textit{e.g.}, Comments of Alcatel-Lucent at 1-2, GN Docket No. 12-354 (filed Dec. 5, 2013) (“Alcatel-Lucent PN Comments”); AT&T PN Comments at 1; CEA PN Comments at 2-3; Nokia PN Comments at 3-4; Comments of PCIA at 3, GN Docket No. 12-354 (filed Dec. 5, 2013) (“PCIA PN Comments”).

\textsuperscript{22} As Google has explained, the Commission should also create a minimum allotment of 50 MHz of spectrum in every market that is guaranteed to be available for GAA operations to account for the possibility that demand for Priority Access networks becomes high enough to otherwise preclude GAA operations. \textit{See} Google PN Comments at 15.
potential applications.”

Nevertheless, some commenters maintain that the Commission’s rules should limit SAS capabilities, or reduce operational flexibility in some subparts of the 3.5 GHz band. The Commission should reject those proposals.


A minority of commenters argues that the FCC should restrict use of SASs “to identifying when spectrum is available for use by either PAL operators or GAA devices.” SAS providers should be allowed to offer far more than a database of available frequencies. As the Commission has recognized, these systems can improve substantially on currently available spectrum management tools. A core goal of this proceeding is to use the 3.5 GHz band as a test bed for innovations, such as SASs, that will help free spectrum for commercial use in the future. The Commission cannot afford to ignore the efficiency gains that full-fledged SASs can deliver to consumers.

Robust SASs will incorporate features that enhance spectrum utilization as compared with a database that makes spectrum availability determinations based on worst-case interference assumptions. For example, as Alcatel-Lucent observes, SASs can facilitate interference avoidance by providing “information about the timing cadence (frame structure) of transmission TX and RX patterns with equipment seeking a frequency channel assignment, in order to protect adjacent channel grantees from receiving interference when nearby equipment is transmitting.”

More broadly, the ability of SASs to perform terrain and physics-based propagation modeling that takes into account specific network-operating parameters and emissions characteristics will

---

23 Public Notice ¶ 33.
24 T-Mobile PN Comments at 12. See also Nokia PN Comments at 15-16.
25 See Google PN Comments at 17-18.
26 Alcatel-Lucent PN Comments at 8.
enable the SASs to manage interactions between networks more efficiently.27 These efficiency gains represent real-world benefits to consumers, by putting more spectrum into intensive use more often and in more communities.

Importantly, the Commission’s rules should promote development of these SAS features by authorizing multiple private entities to provide database functionality on a competitive basis. In doing so, the Commission should not require the “data, software systems, auction methodologies and other information” to “belong to the FCC” once SAS providers develop them.28 If SAS providers must transfer ownership of this intellectual property to the government, or disclose the details of the underlying code to their competitors, they will limit their investment or not enter the market at all. The Commission understands this, and accordingly does not require wireless carriers to transfer ownership of their underlying network control software to the government or to publically disclose proprietary information in order to offer service. It should not impose such requirements for SAS providers, either.

Additionally, although the Commission should guarantee that each SAS complies with FCC rules and implements the protection criteria that all SASs must provide, it should not adopt detailed technical rules that would restrict how SASs determine that spectrum is available for particular uses at a given location. Rather, the specific methods by which an SAS provides the protection required by the rules will be subject to competition over time, driving increasing efficiencies.29

27 See Google PN Comments at 17. See also, e.g., Spectrum Bridge PN Comments at 6-7; Comments of Ericsson at 3, GN Docket No. 12-354 (filed Dec. 5, 2013) (describing network features the SAS could take into account in addition to geography).
28 AT&T PN Comments at 4.
29 See Google PN Comments at 12-13.
Finally, contrary to the suggestions of some commenters, enabling robust SAS capabilities does not mean that SASs would need to unilaterally adjust operating parameters, such as transmit power, once a network has already been deployed. Rather, as Google has explained, SASs should promote efficient spectrum use by “offering” a new entrant the opportunity to transmit at reduced power where operations using the full transmit power limit would result in harmful interference, but operations using lower power levels would not. This process will permit greater efficiency without limiting carriers’ technical decisions.

**B. FCC Rules Should Require Band-Wide Operability.**

Under the Revised Framework, SASs would assign spectrum to Priority Access licensees dynamically. Spectrum not used by Priority Access licensees would be available for GAA devices. As commenters have observed, such dynamic assignment is feasible, and devices can be made to support operations throughout the 3.5 GHz band without significant additional costs. Nevertheless, a handful of parties argue that the Commission should fragment the band based on type of use. For example, Nokia contends that the FCC should confine all GAA operations to a “sand box” in the top portion of the band. Such proposals would dramatically

---

30 See, e.g., Nokia PN Comments at 15-16; T-Mobile PN Comments at 11-12.

31 Google PN Comments at 20.

32 Public Notice ¶ 28.

33 See, e.g. Comments of Motorola Mobility LLC at 4, GN Docket No. 12-354 (filed Dec. 5, 2013) (“Motorola Mobility PN Comments”) (“[I]nteroperability across the 3550-3700 MHz spectrum … will not unduly impact device cost or form factor, because industry is moving towards multi-band power amplifiers, in which a full transmitter chain is not required.”); see also Alcatel-Lucent PN Comments at 8.

34 See Nokia PN Comments at 10-12, 19-20 (GAA use only between 3650-3700 MHz and no opportunistic use). See also Verizon PN Comments at 3 (no GAA use in a portion of the band for an unspecified “interim period”); Motorola Solutions PN Comments at 2-4 (critical users should be entitled to guarantees reservations separate from commercial Priority Access and GAA use).
limit the usefulness of the band. If SASs cannot assign frequencies to GAA use throughout the band, valuable spectrum would lie fallow when not used by incumbents or Priority Access licensees.

Finally, while the Commission should provide for operability throughout the band, it should not mandate interoperability among networks. The latter requirement would necessitate the use of a particular air interface, thereby limiting the ability of the band to accommodate a wide range of uses. The Commission should instead provide operators with flexibility to deploy the network technologies of their choice, as long as those choices are consistent with the band plan, channelization, and operational rules for the 3.5 GHz band.

C. The FCC Should Adopt the Same Power Rules for All Operators.

As Google has explained in its initial comments, a 36 dBm EIRP power limit is appropriate for most 3.5 GHz small cell operations. This limit should apply to Priority Access and GAA users alike. Affording higher power limits solely to Priority Access operations, as T-Mobile and Verizon suggest, would significantly decrease the overall utility of the 3.5 GHz band. Higher power levels for PAL operations would make GAA operations less attractive in the shared spectrum, prompting higher demand for PAL rights when shared GAA operation would otherwise satisfy a user’s needs. PAL operators would be discouraged from lower-powered GAA operations, and GAA operators would be less able to convert successfully to PAL operations. Moreover, to the extent Priority Access and GAA networks relied on separate component and equipment bases to accommodate their different power levels, manufacturers

35 See Motorola Mobility PN Comments at 4.
36 Google PN Comments at 20.
37 See T-Mobile PN Comments at 13-14; Verizon PN Comments at 11-12 (lower power limits “may be appropriate for certain Tier 3 operations”).
would not be able to realize (and pass through) economies of scale. For these reasons, the
Commission should make clear that, while Priority Access status provides a high level of
protection for 3.5 GHz network operations, it does not authorize additional transmit power
beyond that permitted for the GAA tier.

To be sure, certain operations, such as wireless backhaul in rural areas, may benefit from
higher power levels.\(^{38}\) The Commission can accommodate such uses by permitting an increase
in total EIRP while retaining a limit on conducted power.\(^{39}\) Doing so necessarily means that the
signal would be highly directional, thereby limiting the ability of a single Priority Access
licensee to exclude other Priority Access and GAA users over a large area by deploying a single
access point.\(^{40}\)

With respect to existing backhaul operations in the 3650-3700 MHz band, Google agrees
with the Wireless Internet Service Providers Association that these operations should be
grandfathered for a reasonable period of time—such as five years—to facilitate a transition to
operations under the new rules governing the 3.5 GHz band.\(^{41}\) As discussed below, the license
area for these services should be based on the operating parameters and interference protection
requirements needed for a particular deployment, not a standardized geographic area such as a
census tract.

---

\(^{38}\) See, e.g., OTI and PK PN Comments at 15; WISPA PN Comments at 3; PCIA PN Comments
at 5.

\(^{39}\) See Google PN Comments at 20-21.

\(^{40}\) See id. at 20.

\(^{41}\) WISPA PN Comments at 20.
IV. **Priority Access License Areas Should be Highly Local, and Based on Interference Protection Needs Rather Than Geographic Units.**

The characteristics of the 3.5 GHz band—including relatively poor signal propagation—mean that networks with small geographic footprints will be able to use spectrum intensively and efficiently without interfering with other operations in the band.\textsuperscript{42} The Commission can best ensure that its rules capture these benefits by establishing geographic license areas that are limited in size based on protection requirements tailored to operations at a particular cell site.

As a threshold matter, the Commission should not restrict licenses to geographic areas that “approximate existing exclusive-use models”—such as counties or Cellular Market Areas (“CMAs”).\textsuperscript{43} Doing so would limit opportunities for other Priority Access or GAA operations across a broad area, without guaranteeing, or even encouraging, extensive small cell deployment throughout the foreclosed area.

Verizon incorrectly suggests that allowing operators to obtain smaller license units would preclude user mobility. In fact, carriers indicate that they plan to use the 3.5 GHz band for small cells in an effort to account for capacity limitations in areas of high demand. These small cells will operate as part of larger networks, where large and small cells work together to serve consumers—just as carriers use small cells in other bands today.\textsuperscript{44} This being the case, carriers


\textsuperscript{43} See, e.g., Verizon Comments at 10; T-Mobile PN Comments at 6-7 (advocating license areas based on counties); PCIA PN Comments at 4 (recommending that the Commission consider CMA licensing); Alcatel-Lucent PN Comments at 5 (recommending small cell deployments, but also areas such as CMAs for larger networks); Qualcomm PN Comments at 8 (advocating macro-cell licensing outside of exclusion zones originally identified by NTIA); Nokia PN Comments at 5 (license areas should be larger than census tracts).

\textsuperscript{44} See AT&T PN Comments at 4 (noting that “the small cells envisioned by commercial network operators for this spectrum block will be deployed for both capacity and coverage enhancements”).
can integrate small cell 3.5 GHz coverage areas into larger networks using other bands and maintain full mobility where they wish to do so. Furthermore, the European Commission recently determined that “[r]elatively little smartphone data usage is truly mobile.” 45 A large license area does nothing to advance the provision of service when mobile users access the network from a location such as a home, worksite, school, store, transportation center, or sporting event.

Nor would registrations for smaller geographic areas create undue administrative burdens. 46 Rather, as the Public Notice observes, the PAL framework can reduce administrative complexity by eliminating and/or automating many regulatory requirements. 47 For example, as Google has explained, because all commercial networks and devices would register with an SAS to obtain access to 3.5 GHz spectrum, SASs could create records of information on when and where spectrum is being used, all in the normal course of operations. 48 This operational information, together with an ordinary attestation requirement backed by penalties, could form the basis for determining whether a licensee actually is using spectrum, and has therefore met performance criteria. 49

Although the Commission should permit small license areas, commenters have identified numerous difficulties surrounding the Revised Framework’s particular proposal to base licenses


46 See, e.g., T-Mobile PN Comments at 6; Verizon PN Comments at 7.


48 Google PN Comments at 8.

49 See id.
on census tracts. The record reflects that census tracts are unreasonably big for small cell networks;\(^{50}\) would “prove difficult” for deployments in urban environments;\(^{51}\) are based on data that can be “susceptible to over and under inclusion;”\(^{52}\) and can change over time.\(^{53}\)

The Commission should base license areas on spectrum characteristics rather than population characteristics. As Google has explained, an SAS can assign a license based on the applicant’s proposed network equipment and location, as well as the physical characteristics of the area where that network will operate.\(^{54}\) This approach will provide more intensive, more flexible, and lower-cost use of the band compared to a rigid geographic licensing framework.

\(^{50}\) See Microsoft PN Comments at 7 (“Census tracts can cover large swaths of land in rural areas.”); OTI and PK PN Comments at 19 (Commission should consider license areas smaller than census tracts to facilitate “micro-targeted network deployments” and “intensive and efficient use of the spectrum”).

\(^{51}\) See AT&T Comments at 4.

\(^{52}\) PCIA PN Comments at 4.

\(^{53}\) See Alcatel-Lucent PN Comments at 5; PCIA PN Comments at 4.

\(^{54}\) Google PN Comments at 8.
V. CONCLUSION.

The Commission should adopt a three-tier licensing framework for the 3.5 GHz band, enable SASs to manage spectrum access throughout the band with an evolving level of sophistication, and determine license areas for Priority Access networks using actual interference protection requirements rather than standardized geographic areas. This approach will best advance the Commission’s goal of supporting innovation and maximizing the utility of the 3.5 GHz band.

Respectfully submitted,

Austin C. Schlick
Director, Communications Law
Aparna Sridhar
Counsel
GOOGLE INC.
1101 New York Ave., NW, 2nd Floor
Washington, D.C. 20005

Paul Margie
S. Roberts Carter
WILTSHIRE & GRANNIS LLP
1200 Eighteenth Street, NW
Washington, D.C. 20036
(202) 730-1300

Counsel for Google Inc.

December 20, 2013