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

In the Matter of Amendment of Part 15 of the Commission's Rules for Unlicensed White Space Devices	ET Docket No. 16-56 RM-11745

COMMENTS OF GOOGLE INC.

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Across the country, unlicensed users of vacant channels in the broadcast television bands have benefited communities *without* causing harmful interference to protected entities operating in the bands.[1] Indeed, as the Commission recognizes in its *Notice of Proposed Rulemaking (NPRM)* addressing potential changes to its Part 15 rules, no interference has been detected in connection with the registration of fixed white space devices.[2] While it may be beneficial to strengthen the geolocation rules for these devices, the Commission should do so in a way that preserves flexibility and innovation in device and database development. Specifically, the Commission should avoid unnecessarily restrictive technical mandates for geolocation. And in developing any additional rules, the Commission should use the capabilities and limits of today's technology to inform its decision-making process. Finally, the Commission should ensure any additional rules for database providers materially improve the reliability of geolocation information, rather than imposing unjustified burdens on such providers.

The Commission's rules should not mandate detailed procedures or specific technologies for geolocation. Instead, the Commission should use the certification process to ensure that individual devices meet basic performance requirements. This approach has several benefits. First, a high-level rule is more flexible and can be kept stable even as devices and technologies change and improve. Second, allowing implementation to be confirmed in the certification process positions competent

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[1] *See* Opposition of Google Inc., RM-11745, at 10-11 (filed May 1, 2015) (citing deployments in Thurman, New York; California's Gold Country; Wilmington, North Carolina; and libraries and universities nationwide).

[2] *In the Matter of Amendment of Part 15 of the Commission's Rules for Unlicensed White Space Devices*, Notice of Proposed Rulemaking, 31 FCC Rcd. 1657, ¶ 15 (2016) (*NPRM*).

technical staff to evaluate individual solutions as implemented, against concrete, objective measures, rather than requiring the Commissioners to make predictive technical decisions on a paper record. Third, a more flexible approach encourages diversity and competition in developing geolocation solutions. In particular, by preserving its rule allowing devices to report their geolocation capabilities, rather than mandating compliance with a fixed standard such as ±50 meters, the Commission will allow a range of white space devices to operate while motivating manufacturers to improve on today's technologies.[3]

The foundational principle that any new rules should be no more restrictive than absolutely necessary has several corollaries, including the following:

The Commission should not mandate use of one specific technology by all devices. For example, while GPS is widely used in some devices, it is rarely incorporated in access points, which, if portable, are likely to be Mode II devices under the Commission's rules. A technology-specific mandate for GPS capabilities would unduly restrict device development and may become obsolete.

The Commission should accommodate approaches that do not require hardware or software changes. These methods would likely involve the use of geolocation capabilities external to the white space device. For example, a professional installer could use an automated capability to confirm a white space device's location using a

[3] *NPRM* ¶ 30 (citing *In the Matter of Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37*, *et al.*, Report and Order, 30 FCC Rcd. 9551 ¶¶ 75-78 (2015)). Google agrees with the Commission that it is not necessary to modify the default location accuracy requirement from ±50 meters to ±100 meters. *Id.* Nor is it desirable to do so: Devices that can meet a ±50 meters accuracy requirement should be permitted to operate closer to protected systems than those with less accurate geolocation capabilities.

separate, portable geolocation device. Reliable external approaches have substantial potential benefits: they allow devices already deployed in the field to continue operating, and they avoid increasing the cost of white space devices.

Google recognizes that these approaches require some way of verifying that location information is captured at or very near the place where the white space device will be operating. This is readily achievable. For example, location information could be provided either over a wired connection or a short-range wireless communication, such as a Bluetooth connection.

Moreover, to allow meaningful flexibility in external approaches, the Commission should not require devices to re-confirm their locations each day.[4] Such a mandate would radically limit many external approaches to geolocation by requiring a fixed white space device lacking geolocation capability to be co-located with a geolocation device at all times. Given that fixed devices almost certainly will rely on an external power source for operation and thus will turn off if moved, devices should be required to reconfirm their location only when they turn on or reboot.

While the National Association of Broadcasters (NAB) and a number of device manufacturers have suggested particular approaches to accommodating external reporting of geolocation capability,[5] the Commission should not be so prescriptive.[6] For example, the NAB and Manufacturers' Letter proposes that geo-location capability "can

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[4] *NPRM* ¶ 22.
[5] *See id.* at ¶ 10 (citing Letter from Haiyun Tang, Adaptrum, Inc.; James Carlson, Carlson Wireless Technologies, Inc.; Larry W. Koos, Koos Technical Services, Inc.; Jordan Du Val, MELD Technology, Inc.; and Rick Kaplan, National Association of Broadcasters, to Julius P. Knapp, Chief, Office of Engineering and Technology, RM-11745 (filed Jul. 17, 2015) (NAB and Manufacturers' Letter)).
[6] NAB and Manufacturers' Letter at Appendix.

be built directly into the TVBD or can be in a separate device."[7] This approach appears to set up a rigid dichotomy between an internal geolocation approach and one very narrow method for relying on external capability—transmission of geolocation information by a connection such as Ethernet, USB, or serial port. Yet internal, external, or hybrid solutions may provide accurate geolocation.

For instance, while NAB describes one typical external solution (using an external device such as a handheld geolocation location device with a wire that connects to the white space device to obtain location information at the time of configuration), other approaches could work equally well. For example, multi-band devices could rely on a cellular network to monitor and compute their geolocation. This approach is neither strictly internal, because it relies on communication with one or more cell towers, nor is it strictly external, because it relies on triangulation between the device and the towers. Crowd-sourcing is another possible hybrid approach: A white space device could use a cloud-aggregator to derive its location from observations from other geolocation-capable devices. In such cases, location uncertainty would diminish as the number, density, and quality of crowd-sourced observations improves. The Commission should not preclude these sorts of innovative geolocation solutions.

Any new rules for device geolocation should reflect the evolving capabilities of technology. For instance, the Commission should allow wireless transmission of geolocation information from external sources.[8] Today's wireless sources are likely to be as secure as wired sources. The Commission, moreover, can ensure that an external

[7] NAB and Manufacturers' Letter at Appendix.
[8] *See NPRM* ¶ 25.

wireless source is reasonably close to a fixed white space device in a variety of ways—for example, by using device authorization data to establish the range of wireless communications or by using direct range measurement, an aspect of the Wi-Fi standard that supports the measurement of distances between devices. And, as noted above, allowing device makers flexibility in choosing methods both promotes innovation in new geolocation technologies and allows manufacturers to manage costs and other tradeoffs associated with meeting the Commission's geolocation requirements.

New rules should also recognize the *limitations* of today's technologies. In particular, as the Commission recognizes in its *NPRM*, the vertical height accuracy of current GPS systems is limited.[9] Therefore, the Commission should continue to permit manual entry of height information—either directly on the device or by an override of automated methods.[10]

The Commission should not adopt new rules affecting database providers unless they will actually improve accuracy in geolocation reporting. As the Commission has recognized, white space database providers have worked cooperatively and diligently with the Commission to create improved validation requirements and to correct or delete any test or obsolete records.[11] Thus, database providers have shown a willingness to work with the Commission toward changes that improve database integrity and new rules may be warranted only to the extent that they serve this purpose. For example, Google supports clear reporting and categorization of

[9] *Id.* at ¶ 21.
[10] *Id.*
[11] *Id.* at ¶¶ 14, 16.

test devices.[12] This could be accomplished, for example, by requiring manufacturers to register all test devices under the manufacturer's name plus "test"—e.g., "Meld Technologies_test" or "Adaptrum_test." This approach provides a straightforward way to mark test devices without requiring substantial changes to database architecture.

On the other hand, the Commission should not require database providers to confirm the e-mail addresses and telephone numbers provided by device users at the time of registration.[13] This proposed requirement would impose significant burdens on database operators, frustrate users, and create security risks. Sending a validation e-mail and requiring a user response can take a long time, as most e-mail programs are designed to tolerate latency. It may be difficult for the user to provide verification at all, if he or she is in the field without access to e-mail or a web browser. The use of role accounts (e.g., field-techs@example.com), which may not be accessible to individual users, could also frustrate and delay validation. Equally importantly, requiring a response to a validation request adds another avenue for attacks on the database. For example, the validation systems could be turned into spam-bots or instruments for DDOS attacks. For all these reasons, employing the validation approach proposed by the Commission could have unintended consequences that undermine rather than improve the registration process and data integrity.

Finally, any changes adopted in this proceeding should not be applied to the Citizens Band Radio Service. In the 3.5 GHz band, the Commission has permitted professional installers to report geolocation, and the Wireless Innovation Forum

[12] *See id. at* ¶ 15.
[13] *Id.* at ¶ 38.

(WinnForum), a cross-industry, multi-stakeholder group, is developing a program to qualify those installers and to issue appropriate certificates to them. The certificates would then be presented to a Spectrum Access System (SAS) by devices that have been installed by the qualified installer. WinnForum is developing the certification program in conjunction with the Wireless Internet Service Providers Association (WISPA), an organization whose members have significant experience in professional installation of 3.65 GHz equipment.

As the Commission has recognized, any alleged concerns regarding "a dissimilar uncertified professional installation regime in [the white space context] do not warrant eliminating the professional installation option for the Citizens Broadband Radio Service."[14] The proposed approach for the 3.5 GHz band will impose rigorous standards on professional installation at the outset and, for accountability, will provide the Commission with the contact details of the installer of each device. Further, 3.5 GHz devices that operate in coastal urban areas will be required to re-request permission to operate from a SAS on a short timescale in order to protect incumbent military operations. Access to the 3.5 GHz band will be more actively controlled than unlicensed access to the television broadcast bands, and any interference issues can be discovered and fixed rapidly as a result.

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[14] *In the Matter of Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Order on Reconsideration and Second Report and Order, GN Docket No. 12-354, FCC 16-55, ¶ 124 (rel. May 2, 2016).

In its Petition for Rulemaking on this topic, NAB concedes that broadcasters and viewers have experienced "minimal or no impact" as a result of alleged inconsistencies in database entries.[15] Even that is an overstatement, for there has been no harm whatsoever. Absent a showing of harm, it is not clear that the Commission's geolocation rules need to be updated at all. But if the Commission decides to move forward, it should do so in a way that allows unlicensed devices to flourish, avoiding excessively restrictive mandates that will hamper innovation and investment in cutting-edge wireless technologies.

Respectfully submitted,

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[15] Emergency Motion for Suspension of Operations and Petition for Rulemaking of the National Association of Broadcasters, RM-11745, at 2, 9-11, 17 (filed Mar. 19, 2015).