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FEDERAL COMMUNICATIONS COMMISSION

47 CFR Parts 1 and 54

[GN Docket No. 20-32; DA 20-594; FRS 16841]

Office of Economics and Analytics and Wireline Competition Bureau Seek Comment on Adjustment Factor Values for the 5G Fund

AGENCY: Federal Communications Commission.

ACTION: Proposed rule.

SUMMARY: In this document, the Office of Economics and Analytics (Office) and the Wireline Competition Bureau (Bureau) propose and seek comment on specific adjustment factor values for purposes of bidding in the 5G Fund auction as well as for disaggregating legacy support. The Office and Bureau seek comment on these adjustment factor values and specifically on whether these values are appropriate to achieve the Commission's objective of distributing 5G Fund and legacy support to a range of areas across the country that are geographically and economically diverse, and to ensure that the 5G Fund supports those areas that absent such support would be unlikely to reap the benefits of 5G deployment.

DATES: Comments are due on or before July 7, 2020; reply comments are due on or before August 6, 2020.

ADDRESSES: Pursuant to §§ 1.415 and 1.419 of the Commission's rules, 47 CFR 1.415, 1.419, interested parties may file comments and reply comments identified by GN Docket No. 20-32 on or before the dates indicated on the first page of this document. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS). *See Electronic Filing of Documents in Rulemaking Proceedings*, 63 FR 24121 (1998).

- *Electronic Filers:* Comments may be filed electronically using the Internet by accessing the Commission's Electronic Comment Filing System (ECFS) at <https://www.fcc.gov/ecfs/>. Except when the filer requests that materials be withheld from public inspection, any document may be submitted electronically through the Commission's ECFS. Persons that need to submit confidential

filings to the Commission should follow the instructions provided in the Commission's March 31, 2020 public notice, DA 20-361, regarding the procedures for submission of confidential materials.

- *Paper Filers:* Parties who choose to file by paper must file an original and one copy of each filing. Filings can be sent by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.
- Commercial Overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9050 Junction Dr., Annapolis Junction, Annapolis MD 20701.
- U.S. Postal Service first-class, Express, and Priority mail must be addressed to 445 12th St. SW, Washington, DC 20554.
- **Effective March 19, 2020, and until further notice, the Commission no longer accepts any hand or messenger delivered filings. This is a temporary measure taken to help protect the health and safety of individuals, and to mitigate the transmission of COVID-19. See *FCC Announces Closure of FCC Headquarters Open Window and Change in Hand-Delivery Policy*, Public Notice, DA 20-304 (March 19, 2020). <https://www.fcc.gov/document/fcc-closes-headquarters-open-window-and-changes-hand-delivery-policy>.**
- **During the time the Commission's building is closed to the general public and until further notice, if more than one docket or rulemaking number appears in the caption of a proceeding, paper filers need not submit two additional copies for each additional docket or rulemaking number; an original and one copy are sufficient.**

FOR FURTHER INFORMATION CONTACT: Kate Matraves, Economic Analysis Division, Office of Economics and Analytics, (202) 391-6272 or Catherine.Matraves@fcc.gov, or Emily Burke, Auctions Division, Office of Economics and Analytics, (202) 418-1470 or Emily.Burke@fcc.gov.

SUPPLEMENTARY INFORMATION: This is a summary of the *Adjustment Factor Comment Public Notice*, GN Docket No. 20-32, DA 20-594, released on June 5, 2020. The complete text of this document and its appendices is available for public inspection and copying during regular business hours from 8:00

a.m. to 4:30 p.m. ET Monday through Thursday or from 8:00 a.m. to 11:30 a.m. ET on Fridays in the FCC Reference Information Center, Room CY–A257, 445 12th Street SW, Washington, DC 20554, except when FCC Headquarters is otherwise closed to visitors. *See Public Notice, Restrictions on Visitors to FCC Facilities*, March 12, 2020. The complete text of this document and its appendices are also available on the Commission’s website at <https://www.fcc.gov/document/bureau-seek-comment-adjustment-factor-values-5g-fund> or by using the search function for GN Docket No. 20-32 on the Commission’s ECFS webpage at <https://www.fcc.gov/ecfs/>. Alternative formats (braille, large print, electronic files, audio format) are available to persons with disabilities by sending an email to fcc504@fcc.gov or by calling the Consumer & Governmental Affairs Bureau at (202) 418 0530 (voice), (202) 418-0432 (TTY).

I. Introduction

1. On April 23, 2020, the Commission adopted the *5G Fund NPRM and Order*, 85 FR 31636, May 26, 2020, 85 FR 34525, Jun. 5, 2020, in which it proposed to adopt rules and a framework for establishing the 5G Fund for Rural America. Using multi-round reverse auctions, the 5G Fund would provide up to \$9 billion to support 5G service in rural areas of the country that otherwise would be unlikely to see unsubsidized deployment. Every American, including those living in rural areas, should have access to high-speed, mobile wireless broadband networks that are capable of providing 5G service in order to facilitate the development of new technologies, foster economic growth, and ensure that educational opportunities are widely available. To account for the relative costs of serving areas that vary in terrain characteristics and potential business cases, the Commission proposed to apply an adjustment factor to make the most difficult areas to serve more attractive at auction in order to encourage more bidding for these areas. The adjustment factor also would be used to transition legacy high-cost support to 5G Fund support. The Office of Economics and Analytics (Office) and the Wireline Competition Bureau (Bureau) seek comment on proposed adjustment factor values and on three economic analyses that have informed their proposed adjustment factor values.

2. In the *5G Fund NPRM and Order*, the Commission declared its commitment to bridging the digital divide and proposed to dedicate universal service funds to bring 5G mobile wireless service to

the rural areas where there is likely insufficient financial incentive for mobile wireless carriers to invest in 5G-capable networks absent support. In proposing the 5G Fund as a replacement for Mobility Fund Phase II (which focused on 4G LTE), the Commission recognized that all American consumers, not just those living in urban areas, must have access to the most current and advanced technologies and services available in the marketplace in order to fully participate in today's society. By supporting the construction and operation of 5G mobile broadband networks in areas that may otherwise go unserved, the Commission stated that it can help Americans living, working, and traveling in rural communities gain access to communication options on par with those offered in urban areas.

3. The Commission proposed in the *5G Fund NPRM and Order* to use a multi-round, descending clock auction similar to the Connect America Fund Phase II for Phase I of the 5G Fund to identify: (1) the areas that will receive support; (2) the provider that will be assigned to receive support in each such area; and (3) the amount of support that each winning bidder will be eligible to receive. Further, the Commission proposed that bids for 5G Fund support would be accepted and winning bids would be determined based on a support price per adjusted square kilometer of the eligible area covered by the bid. To determine the adjusted square kilometers of the eligible areas, the Commission proposed to incorporate an adjustment factor into the auction design. This factor would assign a weight to be applied to the actual square kilometers of eligible areas that would reflect, among other things, the relative cost of serving areas with differing terrain characteristics, as well as the potential business case for serving each area. In the *Mobility Fund Phase II Report and Order*, 82 FR 154221 (Mar. 28, 2017), 82 FR 13413 (Mar. 13, 2017), the Commission acknowledged that terrain could affect the cost of deploying service, noting that more mountainous terrains with greater variations in slope are areas that tend to be more costly to serve than level plains. A terrain factor was adopted in Mobility Fund Phase II to weight the area of each square kilometer within a census block such that eligible areas in more mountainous areas would be allocated a greater amount of a competitive ETC's total legacy support to reflect the higher costs of serving such areas. The Commission explained in the *5G Fund NPRM and Order* that the auction format proposed for the 5G Fund is one in which a uniform support rate is offered across all eligible areas, and carriers indicate which specific areas they would service at that rate. If the sum of all

payments that would be made at a specific rate given carriers' expressed willingness to serve exceeds the 5G Fund budget, then the rate would decrease and carriers would express their willingness to serve at the lower rate. This process would continue until the payment is less than or equal to the 5G Fund budget. Under this process, carriers would be willing to serve fewer areas as the rate falls, but if the same rate is offered for all remaining areas, more support than is needed would flow to the less costly-to-serve and more profitable remaining areas. The adjustment factor would, therefore, allocate a multiple of any given support rate to more costly and less profitable areas, thereby making them more attractive to serve and increasing the support to such areas.

4. In addition, for purposes of transitioning legacy high-cost support to 5G support, the Commission proposed to disaggregate legacy high-cost support. To account for the relative costs of providing mobile service, the Commission proposed to apply an adjustment factor to these disaggregation steps. This adjustment factor would determine how support will be treated during the transition across difference types of areas—for example, how support will be disaggregated across eligible and ineligible portions of the legacy support area, as well as in eligible portions of the legacy support area where a bidder wins support and where there is no winner. In other words, the Commission proposed to multiply the actual square kilometers of eligible areas and/or disaggregated areas of legacy support by an adjustment factor so as to increase the amount of support per actual square kilometer that goes to more costly or less profitable areas.

5. In the *5G Fund NPRM and Order*, the Commission directed the Office and Bureau to propose and seek comment on the appropriate adjustment factor values and the underlying methodologies that could be used to develop them, and recommended that they inform their proposals by using data from several sources, including the U.S. Geological Survey, historical coverage and infrastructure deployment data received by the Commission, data from the U.S. Census Bureau, spectrum holdings information, and Mobility Fund Phase I auction data. In the *Adjustment Factor Comment Public Notice*, the Office and Bureau propose specific adjustment factor values for purposes of bidding in the 5G Fund auction as well as for disaggregating legacy support. These proposed values reflect the Office and Bureau's evaluation of the costs and benefits of providing 5G services to different geographic areas, as informed and supported

by three economic analyses developed by Commission staff and described in detail in Appendix B to the *Adjustment Factor Comment Public Notice*. The Office and Bureau seek comment on these adjustment factor values and specifically on whether these values are appropriate to achieve the Commission's objective of distributing 5G Fund and legacy support to a range of areas across the country that are geographically and economically diverse, and to ensure that the 5G Fund supports those areas that absent such support would be unlikely to reap the benefits of 5G deployment.

II. Determination of an Adjustment Factor

6. In this section, the Office and Bureau first describe the cost factors underlying the deployment of a 5G network in rural areas, as well as the potential expected revenues for each area, and then propose certain adjustment factor values and provide a summary of the three underlying economic analyses used to develop these values. In Appendix A to the *Adjustment Factor Comment Public Notice*, the Office and Bureau provide a terrain elevation map of the United States. In Appendix B to the *Adjustment Factor Comment Public Notice*, the Office and Bureau provide a detailed description of the three economic analyses under comment, which account for the expected variations in terrain and revenues across different geographic areas.

A. Factors Underlying an Adjustment Factor

7. Deploying 5G wireless networks in rural areas is a capital-intensive investment primarily driven by the costs of deploying base station cell sites. The costs of constructing, operating, and upgrading tower sites, or leasing tower sites, will vary depending on factors such as the location's remoteness, distance to the nearest road, access to backhaul, variance in terrain elevation, land cover, and the cost of local construction and installation labor. The potential coverage area of a site, and hence the number of sites needed, in turn will depend on the specific site location, antenna height above average terrain, terrain variation, foliage and the density of local structures, the spectrum band, and the number of subscribers served. Terrain variation can limit overall signal propagation and cell coverage depending on the specific location of the cell site due to the obstructions of the signal's path. For example, in a hilly area with terrain obstacles, signal propagation losses are more severe at higher frequencies, although a cell site would typically be located on higher ground in order to minimize terrain obstructions.

8. *Site Costs.* The initial capital expenditure for deploying a wireless network base station includes site construction costs, such as site acquisition; site development; leasehold improvements; shelter, including the equipment shelter and installation services; structure cost including the tower structure, design, construction, and installation costs; radio frequency cost including the radio and baseband electronics, antennas, and cables; and backhaul cost including equipment and service to connect the site to the core network. Collocation on an existing tower generally should cost less than building a new tower site, but it is less likely that existing towers are available in more remote and unserved areas. In addition, deploying new sites in hillier terrain is likely to incur higher site costs due to the need to construct backhaul and leasehold improvement requirements such as constructing road and utility access, in addition to excavating a level space with proper drainage to construct a tower. Remote site development costs are largely dependent on the specific location and the leasehold improvements required can vary significantly. It is typically more expensive to provide service to rural subscribers due to the scarcity of utility and other services and the long distances required to travel to reach the sites in less densely populated areas, especially if terrain is more mountainous.

9. *Spectrum.* Spectrum bands can be classified broadly as: low-band (below 1 GHz), mid-band (between 1 GHz and 6 GHz), and high-band. Each band has unique coverage and capacity properties; low-band spectrum is better suited for wider coverage (both in terms of range as well as better indoor penetration) and higher-band spectrum is better suited for higher capacity and throughput. The wavelength of the signal, which is inversely proportional to frequency, impacts the signal's ability to propagate over and around obstacles and to penetrate various building materials and land cover such as trees and shrubs. A higher frequency signal is generally attenuated more at greater distances than a lower frequency signal due to antenna and atmospheric effects. Frequencies below 1 GHz experience lower propagation losses and therefore can provide coverage over a larger area which leads to cost advantages for network deployment in rural areas. Higher frequency bands, on the other hand, are typically available in larger channel bandwidths which lead to higher throughput speeds but the wavelength of the signal results in greater propagation losses. A higher frequency signal generally encounters higher penetration losses as it propagates through obstructions such as buildings or trees; larger amounts of contiguous

spectrum are typically available in higher operating frequencies than in lower frequencies. The additional contiguous spectrum, however, allows for assignment of larger channel bandwidths, thereby making available more capacity as compared to lower frequencies. Mobile wireless carriers, depending on their spectrum holdings, may be able to simultaneously deploy low and mid-band spectrum in rural areas to take advantage of both propagation and capacity capabilities, respectively. If the cost of spectrum is lower in more rural areas, this could significantly offset many of the other higher site costs. In addition, 5G technology enables carrier aggregation to further optimize the desired coverage, throughput, and capacity. Carrier aggregation enables the use of two different channels within the same frequency spectrum or in different spectra, allowing, for example, the augmentation of low band propagation capabilities with mid band capacity advantages.

10. The Office and Bureau propose to use various cost characteristics as outlined here and described in more detail in Appendices A and B to the *Adjustment Factor Comment Public Notice*—including terrain elevation, spectrum frequency and clutter—to capture the relative cost of serving areas with differing terrain characteristics. The Office and Bureau seek comment on this proposal.

11. *Business Case: Demand Factors.* As well as being geographically diverse, the United States is economically diverse. As set out in the *5G Fund NPRM and Order*, in addition to relative cost characteristics, the adjustment factor values the Office and Bureau propose should also capture the expected revenues that might be generated in each area. The Office and Bureau propose to use various economic characteristics—including income, GDP, and population density—as proxies for the demand factors in each of the economic analyses. The Office and Bureau seek comment on this proposal.

B. Proposed Adjustment Factor Values

12. The Commission proposed in the *5G Fund NPRM and Order* to adopt an adjustment factor that would assign a weight to specific geographic areas. The proposed adjustment factor values would increase the likelihood that 5G Fund support is distributed to geographically and economically diverse areas by taking into account the differences among such areas in the costs and benefits of

providing services. The Commission also proposed a process in the *5G Fund NPRM and Order* to disaggregate legacy high-cost support. As the Commission explained, to disaggregate legacy support, it “would overlay the boundaries of eligible areas and the minimum geographic area for bidding over each legacy support recipient’s service area[.]” in effect “subdivid[ing] the geographic boundary for each carrier’s subsidized service area into the smallest constituent piece for which support must be disaggregated and transitioned separately” and then apply the adjustment factor to each such area. In this way, a larger portion of a carrier’s disaggregated legacy high-cost support would be assigned to those portions of its subsidized service area that have a higher adjustment factor, using the same values calculated for bidding. For example, suppose that a carrier receives \$100 in legacy high-cost support for its subsidized service area, the entirety of which is eligible for 5G Fund support. If 15 square kilometers of the service area falls within census tract A, which has an adjustment factor value of 2.0, and 70 square kilometers of the service area falls within census tract B, which has an adjustment factor value of 1.0, the Commission would disaggregate its legacy support and assign \$30 to the portion of the service area in census tract A and \$70 to the portion of the service area in census tract B. The *5G Fund NPRM and Order* directs the Office and Bureau to propose specific values for the adjustment factor and to detail the underlying methodologies that could be used to develop the weights. The Office and Bureau accordingly seek comment on how to apply the adjustment factor to the disaggregation of legacy support.

13. First, the Office and the Bureau seek comment on the adjustment factor values presented in Figure 1, which synthesize and are informed by the three economic analyses. Each of the economic analyses estimates one or more sets of adjustment factor values. To generate the values presented in Figure 1, essentially the Office and Bureau considered a middle ground of the three specific analyses so as to take all three analyses into account, and then rounded for administrative simplicity. The Office and Bureau believe this is the most reasonable way to integrate all the results generated by the Entry Model, the Cell Site Density Model and the Auction Bidding Model. The explanation of the three terrain categories and the demand factors listed in Figure 1 can be found in Appendix A and Appendix B to the *Adjustment Factor Comment Public Notice*, respectively. The Office and Bureau seek comment generally on their proposed adjustment factor values. The Office and Bureau recognize that the Commission does

not intend that the adjustment factor that is ultimately adopted will capture the full differences between the costs and expected revenues of providing service to different types of geographic areas. In addition, the Commission stated in the *5G Fund NPRM and Order* that, if necessary, the adjustment factor will be capped to ensure the funding allocation determined by the auction is both equitable and efficient. Commenters are invited to address whether the specific proposed adjustment factor values are consistent with the intentions of the Commission as stated in the *5G Fund NPRM and Order*.

Fig. 1: Proposed Adjustment Factor Values

		Terrain Elevation		
		Flat	Hilly	Mountainous
Demand Factors	Low	1.2	2.4	3.8
	Medium	1.1	2.3	3.5
	High	1.0	2.0	3.0

14. The Office and Bureau seek comment also on the three economic analyses that inform their estimated adjustment factor values. The technical descriptions of the three economic analyses which informed the Office and Bureau’s proposal are found in Appendix B to the *Adjustment Factor Comment Public Notice*. The Office and Bureau ask commenters to submit any analysis that alternatively or additionally might inform the adjustment factor values that the Office and Bureau propose. Further, the Office and Bureau seek comment on the data sources staff used, and ask that commenters submit alternative data sources to the extent that they might better inform the Office’s and Bureau’s analyses. In addition, the Office and Bureau seek comment on whether, in determining whether an area would be likely to receive 5G service, the Office and Bureau have identified appropriately the underlying factors that wireless carriers use in considering whether to deploy 5G service. Finally, the Office and Bureau ask commenters to submit any alternative methodological approaches and analyses for determining the appropriate adjustment factor values.

15. *Entry Model Adjustment Factor*. In order to estimate how relative costs and revenues differ across geographic areas, the Office and Bureau’s first analysis examines how geographic areas’

physical and demographic characteristics affect carriers' network deployment decisions. The Office and Bureau assume that carriers only enter areas where their long-run incremental revenues are greater than their long-run incremental cost of deploying wireless mobile service; this implies those areas with high demand and low costs attract a greater number of carriers than those areas with low demand and high costs. To understand what makes an area attractive to carriers, the Office and Bureau estimate an ordered logistic regression of the number of carriers providing service. To proxy for the carriers' expected revenue generated by entering the area and providing service, the Office and Bureau include independent variables such as population, local GDP, and median household income. To proxy for network deployment costs, the Office and Bureau include independent variables such as terrain variation and the percentage of forested land. Finally, the Office and Bureau include a variable that accounts for past universal service support. To construct the adjustment factor, the Office and Bureau solve for the adjustments necessary to offset entry probability differences caused by variations in terrain and income. The Commission has proposed in the *5G Fund NPRM and Order* that the adjustment factor would be applied in the auction bidding system as a multiplicative factor on the number of square kilometers associated with a biddable area, so the Office and Bureau estimate the adjustment factor values that, all else equal, would make the adjusted square kilometers in all areas equally attractive to bidders. To ensure that the model's estimated parameters and resulting adjustment factors are robust to alternative assumptions, the Office and Bureau report the estimation results and the accompanying factors from twelve different specifications of the model.

16. *Cell Site Density Model Adjustment Factor.* In their second analysis, the Office and Bureau estimate the difference in the number of cell sites required to provide high-quality 5G service in hillier terrain areas compared to flat areas. Since more variability in the terrain of a cell site service area tends to reduce the received signal strength at a given location, wireless carriers must, all else equal, build more cell sites in mountainous rural areas compared to flat rural areas to provide the same quality of service (e.g., speed). Using county-level cell site locations and coverage data, the Office and Bureau's model estimates differences in the average coverage area of a site due to the terrain of the site service area, holding all other determinants of cell site coverage areas fixed. To predict cell site coverage areas

by terrain category, the Office and Bureau first run a regression analysis of cell site coverage area on variables that account for network capacity, network load, signal propagation, and service quality. Then using the regression model estimates, the Office and Bureau predict the average coverage area of a site in a typical rural area for their three terrain categories (flat, hilly, and mountainous) to calculate an adjustment factor that estimates how many sites per square mile on average are required to deploy comparable 5G mobile service in rural areas within each terrain category. If cell site deployment costs are the same across terrain categories, the adjustment factor values estimate the cost differences in providing wireless service across terrain types. If sites cost more to deploy in more mountainous terrain, then the adjustment factor values are underestimated. The Office and Bureau do not have information on deployment cost variation by terrain, so these potential cost differences are not accounted for in the estimated adjustment factors in the Cell Site Density Model.

17. *Auction Bidding Model Adjustment Factor.* In their third analysis, the Office and Bureau use Mobility Fund Phase I (Auction 901) sealed bid data (i.e., a firm's requested subsidy to provide mobile service to a specified unserved geographic area) to understand how terrain and other factors impact the bid amount requested by a carrier to deploy service. The Office and Bureau assume that a carrier's bid amount is a function of its expected revenues, expected competition in the auction, and expected costs. The Office and Bureau estimate adjustment factor values by applying a regression model that estimates the effect of terrain on the bid amount controlling for variables that determine revenues and costs. To calculate adjustment factor values, the Office and Bureau divide their measure of terrain into the same three categories and then predict the expected ratio of bid amounts in the hilly and mountainous terrain categories over the bid amount in flat terrain while holding all other factors fixed.

III. Procedural Matters

18. *Ex Parte Rules—Permit-But-Disclose.* Pursuant to § 1.1200(a) of the Commission's rules, 47 CFR 1.1200(a), this document shall be treated as a "permit-but-disclose" proceeding in accordance with the Commission's *ex parte* rules. Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies).

19. Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must (1) list all persons attending or otherwise participating in the meeting at which the *ex parte* presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter's written comments, memoranda or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with § 1.1206(b) of the Commission's rules, 47 CFR 1.1206(b). In proceedings governed by § 1.49(f) of the Commission's rules, 47 CFR 1.49(f), or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (e.g., .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules.

Federal Communications Commission.

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