6712-01

FEDERAL COMMUNICATIONS COMMISSION

47 CFR Parts 27 and 73

[GN Docket No. 12-268; ET Docket Nos. 13-26 and 14-14; FCC 14-157]

Expanding the Economic and Innovation Opportunities of Spectrum through Incentive Auctions

AGENCY: Federal Communications Commission.

ACTION: Proposed rule.

SUMMARY: This document seeks comment on proposed rules to govern the interference relationship between broadcast television and wireless service in the 600 MHz Band following the incentive auction. The Commission anticipates that after the auction some broadcast television stations may operate on channels in the 600 MHz Band as a result of market variation. The Commission proposes to allow no harmful interference from wireless operations to reception of television service; the Commission proposes to require wireless licensees to use proposed OET Bulletin No. 74 (OET-74) before deploying base stations; and seeks comment on how the ISIX Methodology and inputs adopted in the companion Second Report & Order can be adapted to predict inter-service interference between wireless services and analog television stations in Canada and Mexico, for purposes of identifying license impairments during the auction. In addition, the Commission proposes not to permit broadcast licensees who operate in the 600 MHz Band to expand their noise-limited or protected contours if doing so would increase the potential for interference to a wireless licensee's service area.

DATES: Comments must be filed on or before [**INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER**], and reply comments must be filed on or before [**INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER**].

ADDRESSES: You may submit comments, identified by GN Docket No. 12-268 and ET Docket Nos. 13-26 and 14-14, by any of the following methods:

- Federal eRulemaking Portal: http://www.regulations.gov. Follow the instructions for submitting comments.
- Federal Communications Commission's Web Site: http://www.fcc.gov/cgb/ecfs/. Follow the instructions for submitting comments.
- Email: [Optional: Include the E-mail address only if you plan to accept comments from the general public]. Include the docket number(s) in the subject line of the message.
- Mail: [Optional: Include the mailing address for paper, disk or CD-ROM submissions needed/requested by your Bureau or Office. Do not include the Office of the Secretary's mailing address here.]

For detailed instructions for submitting comments and additional information on the rulemaking process, see the SUPPLEMENTARY INFORMATION section of this document.

FOR FURTHER INFORMATION CONTACT: Aspasia Paroutsas, Office of Engineering and Technology, 202-418-7285, Aspasia.Paroutsas@fcc.gov, TTY (202) 418-2989.

SUPPLEMENTARY INFORMATION: This is a summary of the Commission's Second Report and Order and Further Notice of Proposed Rule Making, GN Docket no. 12-268 and ET Docket No. 13-26 and 14-14; FCC 14-157, adopted October 16, 2014, and released October 17, 2014. The full text of this document is available for inspection and copying during normal business hours in the FCC Reference Center (Room CY-A257), 445 12th Street, SW., Washington, DC 20554. The complete text of this document also may be purchased from the Commission's copy contractor, Best Copy and Printing, Inc., 445 12th Street, SW., Room, CY-B402, Washington, DC 20554. The full text may also be downloaded at: www.fcc.gov.

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 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 ECFS: http://fjallfoss.fcc.gov/ecfs2/.
- Paper Filers: Parties who choose to file by paper must file an original and one copy of each filing. If more than one docket or rulemaking number appears in the caption of this proceeding, filers must submit two additional copies for each additional docket or rulemaking number. Filings can be sent by hand or messenger delivery, 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.
    - All hand-delivered or messenger-delivered paper filings for the Commission's Secretary must be delivered to FCC Headquarters at 445 12th St., SW, Room TW-A325, Washington, DC 20554. The filing hours are 8:00 a.m. to 7:00 p.m. All hand deliveries must be held together with rubber bands or fasteners. Any envelopes and boxes must be disposed of before entering the building.
    - Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9300 East Hampton Drive, Capitol Heights, MD 20743.
    - U.S. Postal Service first-class, Express, and Priority mail must be addressed to 445 12th Street, SW, Washington DC 20554.

People with Disabilities: To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an e-mail to fcc504@fcc.gov or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (tty).

Summary of the Further Notice of Proposed Rulemaking

1. In this Further Notice of Proposed Rule Making (FNPRM), the Commission seeks comment on proposed rules to govern the interference relationship between broadcast television and wireless service in the 600 MHz Band following the incentive auction. As discussed in the companion Second Report & Order, the Commission anticipates that after the auction some broadcast television stations may operate on channels in the 600 MHz Band as a result of market variation. The Commission

proposes to allow no harmful interference from wireless operations to reception of television service. There are two scenarios that present the potential for harmful interference to television stations, depending on whether a station is assigned to the 600 MHz Band downlink or uplink spectrum. First, if a station is located in the downlink spectrum, we will need to protect against harmful interference from wireless base stations to TV receivers (Case 3). Second, if a station is located in the uplink spectrum, the Commission will need to consider interference from wireless user equipment to TV receivers (Case 4). As an initial matter, this FNPRM addresses the level of inter-service interference to television stations in the 600 MHz Band that should be permitted. The Commission also proposes a methodology for new 600 MHz Band licensees to predict whether wireless operations will interfere with television stations in the 600 MHz Band in order to identify the "permitted boundaries" of wireless license areas following the auction. Specifically, for Case 3 scenarios, the Commission seeks comment on requiring wireless licensees to use proposed OET Bulletin No. 74 (OET-74). For Case 4 scenarios, the Commission proposes to adopt the same fixed separation distances adopted in the companion Second Report & Order for use in the incentive auction. In the event that wireless operations actually cause harmful interference to television reception in the 600 MHz Band where interference was not predicted to occur, we also propose to require wireless providers to take action to eliminate the interference.

2. The Commission also seeks comment in this FNPRM on procedures to prevent inter-service interference following the incentive auction. It proposes to require wireless providers to analyze potential interference to any co-channel or adjacent channel television station in the 600 MHz Band within a set distance using the methodology in OET-74 before deploying base stations, regardless of whether the wireless license area was identified as "impaired" in the auction. The Commission also proposes to allow broadcast television stations in the 600 MHz Band to modify their facilities only to the degree that doing so does not extend their contours in the direction of a co-channel or adjacent-channel 600 MHz Band wireless license area within a set distance.

3. This FNPRM also seeks comment on how the ISIX Methodology and inputs adopted in the

companion Second Report & Order for predicting interference to wireless operations from television stations (Cases 1 and 2) should be modified to predict harmful interference that LPTV and TV translator stations may cause to 600 MHz Band wireless service as it is deployed following the auction. Further, the Commission proposes to allow new 600 MHz Band wireless licensees that intend to deploy facilities during the 39-month Post Auction Transition Period to use the ISIX Methodology and inputs, as detailed in the proposed OET-74, to determine whether there is any potential for harmful interference to a television station that has not yet cleared its pre-auction channel in the 600 MHz Band.

4. Finally, the Commission seeks comment on how the ISIX Methodology and inputs adopted in the companion Second Report & Order can be adapted to predict inter-service interference between wireless services and analog television stations in Canada and Mexico, for purposes of identifying license impairments during the auction.

Protecting Television Stations in the 600 MHz Band from Inter-Service Interference

Proposed Threshold for Interference from Wireless Operations to Television Stations in the 600 MHz Band

5. The Commission proposes to establish a zero percent threshold for harmful interference. Under this approach, 600 MHz Band wireless licensees would not be permitted to cause harmful interference within the service area of a full power station or the protected contour of a Class A station, to the degree it affects population within that service area or protected contour.

6. The Commission proposes this threshold for a number of reasons. First, a different, more cautious approach may be warranted than in the context of preventing harmful interference between television stations because this will be the first time such proposed methodology is used. Second, the Commission does not believe that a zero percent interference threshold would undermine the goals for the incentive auction. Third, the Commission is concerned that there is a potential for significant aggregate new interference from wireless operations to television stations if it set a de minimis threshold. The is no

safety valve measures available to address aggregate wireless interference like they are in addressing aggregate television-to-television interference, and the risk of significant levels of new aggregate wireless interference is higher. Six megahertz channels in the television bands are aligned, and only a limited number of television stations can operate on the same or adjacent channels in nearby areas. In contrast, varying degrees of spectral overlap between six-megahertz television channels and five-megahertz wireless spectrum blocks in the 600 MHz Band, along with the different technical facilities employed by television and wireless services, create the potential for multiple co- and adjacent-channel relationships between television stations and wireless operations in the 600 MHz Band in the same or nearby geographic areas. Fourth, the Commission does not think that an aggregate threshold for interference to television stations from wireless operations would be either feasible or practical. For these reasons, the Commission proposes a zero percent threshold for interference from wireless operations to television stations following the incentive auction.

7. In the event that interference is predicted between television stations assigned in the 600 MHz Band, the Commission proposes to treat that interference as "masking interference" in evaluating wireless interference to a television station. That is, in a grid cell where masking interference to one television station from another is predicted to occur, the Commission proposes to ignore the inter-service interference from the wireless operations. This approach would be consistent with the treatment of interference between television stations under the rules. The Commission seeks comment on this proposal.

Proposed Methodology and Inputs for Predicting Interference to Television Stations in the 600 MHz Band from Wireless Operations

Case 3: Interference from Wireless Base Stations to Television Stations Assigned to the 600 MHz Downlink Spectrum

8. If television stations are assigned to the 600 MHz Band downlink spectrum, the Commission proposes to (1) prohibit a wireless licensee from operating base stations within the contour

of a co-channel or adjacent-channel DTV station and (2) require the wireless licensee to use the proposed OET-74 to predict interference to such station's service prior to deploying wireless base stations within a specified culling distance of the station's contour. The Commission seeks comment on these proposals. The culling distances proposed are based on the spectral overlap between wireless operations and broadcast television operations, and the power and antenna height of wireless base stations. The Commission seeks comment on this proposal and the specific distances proposed in OET-74. Because there is the potential for impairments in any license that is co-channel or adjacent channel with a broadcast television station, the Commission proposes to apply these requirements to all wireless operations within the culling distance that are co-channel or adjacent channel to a broadcast television station, regardless of whether the wireless licensee's spectrum block was identified as "impaired" in the auction.

9. The proposed methodology and input values for predicting interference from a wireless base station into DTV service are set forth in detail in the proposed OET-74. The OET-74 methodology is similar to the ISIX Methodology for Case 3 adopted in the companion Second Report & Order, but instead of a placement of hypothetical wireless base stations and the associated technical parameters, wireless providers would be required to use the actual technical parameters of their base stations. The Commission proposes to require wireless providers planning co-channel or adjacent-channel operations with any television stations in the 600 MHz Band downlink spectrum to apply the OET-74 methodology using the actual location, HAAT, ERP, and antenna pattern and orientation of their base stations prior to deployment of such facilities within the specified culling distance of a television station's contour. To provide wireless providers with additional flexibility, the Commission also proposes to allow them to elect to use omnidirectional patterns in their analyses rather than actual antenna patterns, either in azimuth or elevation. The Commission requests comment on this proposal.

10. The Commission proposes to incorporate the root sum square (RSS) method into OET-74 to predict the potential for aggregate interference to a television station from multiple wireless base

stations. As noted, broadcasters raise concerns with regard to the potential for interfering LTE signals to combine at the point of DTV signal reception, resulting in additional interference. In the Second Report & Order, the Commission declined to apply the RSS method during the auction because the predictions of inter-service interference will be based on a hypothetical network deployment. In contrast, because proposed OET-74 would be based on real-world network deployments, the Commission believes that its accuracy would be improved by application of RSS method. Accordingly, the Commission proposes to aggregate the interfering field strength at the DTV receiver from the actual wireless base stations to be deployed post-auction using the RSS method.

11. The Commission proposes to specify in OET-74 the same D/U and OFR ratios adopted in the Second Report & Order for predicting interference from wireless base stations to DTV reception during the auction. For the reasons stated in the Second Report & Order, the Commission believes the same values adopted there are appropriate to use as the thresholds for predicting interference in the post-auction environment. The Commission requests comment on this proposal.

12. The Commission proposes to require that a 600 MHz Band wireless licensee perform an interference analysis using the methodology in OET-74 prior to deploying a base station for co-channel or adjacent-channel operations with the televisions stations within the set culling distance. The Commission anticipates that wireless providers will use their own network planning software to process the OET-74 studies, but the Commission's TVStudy software would be made available for this purpose as well. Before deploying a new base station or making changes to existing base stations located within the specified OET-74 culling distances for co-channel or adjacent-channel operations with a television station, a wireless licensee would have to update its interference analysis to ensure that the RSS evaluations are up-to-date and accurate. The wireless licensee would be required to retain the latest copy of its interference analysis for each co-channel or adjacent-channel Partial Economic Area (PEA) license area where any of its base stations fall within the specified OET-74 culling distances and make the analysis available to the Commission or a subject television station upon request in cases where there are

complaints of interference either from the subject television station, a station viewer or the Commission. The Commission seeks comment on these proposals.

Case 4: Interference from Wireless User Equipment to Broadcast Television Stations Assigned to the 600 MHz Uplink Spectrum

13. If broadcast television stations are assigned to channels in the 600 MHz Band uplink spectrum, the Commission proposes to restrict wireless user equipment (i.e. mobile and portable devices) operating on co-channel or adjacent-channel frequencies to areas outside the separation distances from the DTV station contours adopted in the Second Report & Order. First, for co-channel operations, the Commission proposes to not allow wireless user equipment to operate within the television station's contour and within five kilometers of that contour. Second, for adjacent channel operations, the Commission proposes to restrict user equipment operation within the contour of the television station and within one-half kilometer of that contour. The Commission proposes to limit the one-half kilometer restriction to the first-adjacent channel; thus, wireless user equipment could be operated anywhere within the contour of a broadcast television station if there is a frequency separation of six megahertz or more between the wireless spectrum block edge and a TV channel edge. The Commission seeks comment on the proposals for protecting DTV service from harmful interference caused by wireless user equipment. Wireless providers may meet the distance requirements by limiting their coverage area to areas that are at least five kilometers if co-channel with a broadcast television station or one-half kilometer if they are adjacent channel outside the noise-limited or protected contours of the broadcast television station. Interested parties are also invited to submit suggestions for alternative approaches for providing protection to broadcast television service that would rely on methods other than pre-calculated separation distances. Parties submitting such approaches should include technical analyses and information describing how their suggested method would adequately protect broadcast television services.

Proposed Obligation of Wireless Licensees to Eliminate Actual Interference to Television Stations in the 600 MHz Band

14. While the Commission proposes to use a predictive model to prevent inter-service interference to television stations based on wireless base station deployments, it also proposes to require a wireless licensee to eliminate any actual harmful interference to television service in the 600 MHz Band, even if no harmful interference is predicted. This proposed requirement will ensure that television stations assigned to the 600 MHz Band are not detrimentally affected by being co-channel or adjacent channel to wireless operations.

15. If a television station operating in the 600 MHz Band experiences harmful interference, the Commission proposes that the television station be required to contact the co-channel or adjacent-channel wireless provider thought to be causing the interference to resolve the issue. In the event of such contact, the Commission proposes to require that the wireless licensee provide the television station with the results of its OET-74 analysis demonstrating that no harmful interference was predicted to occur in the specific geographic area at issue. In the event that the parties do not reach resolution, they can submit a claim of harmful interference to the Commission. The Commission seeks comment on these proposals.

Proposed Procedures to Prevent Inter-Service Interference

General Wireless Licensee Obligations

16. Given the proposed rules set forth in the FNPRM, the Commission seeks comment on appropriate wireless licensee obligations, both with respect to technical requirements and service rules. Specifically, consistent with the guidance set forth in the Incentive Auction R&O, the Commission proposes that a 600 MHz Band licensee will hold a license for its entire PEA service area, but operations will be limited to the portions of the license where the licensee will not cause harmful interference to broadcast television stations assigned to the 600 MHz Band. Under this proposal, a

wireless licensee will be allowed to operate base stations at the power and out-of-band emission (OOBE) limits authorized by the technical rules only within the areas where it can demonstrate using the proposed OET-74 methodology and inputs that it will not cause harmful interference to a television station, even if the actual boundaries of the license area extend further (i.e., it may not operate in "restricted" areas). As the Commission stated in the Incentive Auction R&O, nothing in the rules prevents a wireless provider from operating in a part of its service area in which it may receive interference from broadcast operations (i.e., in an "infringed" area). The Commission seeks comment on the obligations of 600 MHz Band wireless licensees in operating in areas of their PEAs with impairments.

17. As discussed in the Incentive Auction R&O, 600 MHz Band wireless licensees will be required to meet the 600 MHz Band interim and final build-out requirements, except that they may show they are unable to operate in areas where they may cause harmful interference to the broadcast television stations that remain in the 600 MHz Band due to market variation. The areas where a wireless licensee may operate without causing harmful interference are the "permitted boundaries" of a license area. If a licensee is not able to serve its entire license area, when it files its construction notification within 15 days of the relevant milestone certifying that it has met the applicable performance benchmark within its permitted boundaries, the licensee must demonstrate why certain areas are excluded from its service area due to impairments. The Commission proposes to require that wireless licensees use the ISIX Methodology adopted in the Second Report & Order for prediction of interference in Cases 1, 2 and 4 and the methodology in proposed OET Bulletin 74 for Case 3 to demonstrate they cannot serve their entire PEA service area, among other evidence. Further, as discussed in the Incentive Auction R&O, if the impairing television station ceases to operate, the wireless licensee will be permitted to use the entire license area, and will be obligated to serve the area that was previously restricted in demonstrating that it has met its buildout requirements.

18. Additionally, the Commission seeks comment on any additional or modified service rules

that should be applied to 600 MHz Band licensees to address the potential for inter-service interference.

Broadcasters in the 600 MHz Band

19. Consistent with the guidance in the Incentive Auction R&O, the Commission proposes not to permit broadcast licensees who operate in the 600 MHz Band to expand their noise-limited or protected contours if doing so would increase the potential for interference to a wireless licensee's service area. At the same time, the Commission tentatively concludes that broadcast television stations should be allowed to demonstrate non-interference to a wireless licensee's service area by showing that a proposed modification will not expand its contour in the direction of a co-channel or adjacent channel wireless licensee. This approach will ensure that wireless providers that acquire spectrum through the forward auction can rely on the information available at the time of the auction as to the existence and contours of a co-channel or adjacent television station, and rely on their modeling using OET Bulletin 74 for as long as the such television station is operating. The Commission seeks comment on this proposal.

20. The contours of broadcast television stations that will be reassigned to new channels in the 600 MHz Band as a result of the repacking process will be specified in the Channel Reassignment PN. For such stations to be able to engineer their modified facilities and quickly transition to their new channels, in the Incentive Auction R&O the Commission granted them a window filing priority to propose transmission facilities in their initial construction permit applications with up to a one percent coverage contour increase if necessary to achieve the contour coverage specified in the Channel Reassignment PN or to address loss of coverage area resulting from their new channel assignment. Consistent with that decision, for purposes of the proposal set forth immediately above, the Commission proposes that the contours of such stations be deemed to be those described in their initial construction permit for their new channel. The impact on a wireless licensee of allowing stations reassigned to channels in the 600 MHz Band such flexibility would be negligible because a one percent increase is de minimis the increase may not be in the direction of the wireless licensee, and the initial

construction applications must be filed within three months of release of the Channel Reassignment PN. The Commission does not propose, however, that these stations be permitted to file for further expanded facilities on their new channels, unless they can demonstrate that the proposed expanded facility will not increase their contour in the direction of a wireless license area. The Commission seeks comment on these proposals.

Predicting Inter-Service Interference During the Post-Auction Transition Period

Predicting Interference to New 600 MHz Band Licensees from LPTV Stations and TV Translators for Notification Purposes

21. In the Incentive Auction R&O, the Commission stated that during the Post-Auction Transition Period new 600 MHz Band wireless licensees intending to commences operations in areas of their licenses where there is a likelihood of receiving harmful interference from an LPTV or TV translator station, based "on the methodology the Commission adopted to prevent inter-service interference," must provide LPTV and TV translator stations with advance notification that they will be displaced. In the Second Report & Order, the Commission adopted the ISIX Methodology and input values to predict interference from full power and Class A television stations to wireless services during the course of the auction.

22. The Commission seeks comment on appropriate modifications to the ISIX Methodology to predict interference to 600 MHz Band wireless operations from LPTV and TV Translators. First, the Commission seeks comment on use of the field strength values below for predicting such interference. The interference potential of LPTV and TV Translators that have migrated their operations to digital is evaluated differently from that of full power DTV stations under the rules. In particular, the rules specify different values for the adjacent channel emissions and elevation patterns of low power and full power DTV stations. The Commission examined the effect of the different LPTV/TV translator emission masks, however, and found that the field strength thresholds of these masks and the full power television mask is no more than 1dB. Therefore, the Commission proposes to use the same field

strength values as full power television for the interference thresholds of co-channel and adjacent channel emissions for LPTV and TV translators to wireless service in the ISIX Methodology. Those thresholds are based on technical assumptions regarding the wireless receivers (both base stations and user equipment) that appear respectively in Tables 5 and 6 in the ISIX PN, as well as Tables 3 and 4 in the Technical Appendix of the Second Report and Order.

23. In addition, the Commission proposes to use the same elevation patterns for LPTV and TV translators as those patterns appear in the Consolidated Database System (CDBS). In the event the CDBS does not include elevation pattern values for a given low power station, it proposes to use the elevation patterns of LPTV and TV translators as they are defined in § 74.793(d) of the Commission's rules.

24. In the event a potentially interfering LPTV or TV translator station is operating an analog signal, the Commission invites comment on additional modifications to the methodology for predicting inter-service interference that may be appropriate. One potential approach is to use TVStudy's capability to "replicate" an analog signal as an equivalent digital signal and analyze the station as though it were operating in digital. The Commission seeks comment on this approach and on any other potential approaches. In the event it uses the TVStudy approach, the Commission seeks comment on whether it should treat the interfering field strength of an analog television signal the same as an interfering digital television signal.

Wireless Operations Prior to Broadcast Television Station Relocation

25. As set forth in the Incentive Auction R&O, wireless providers may commence operations prior to the end of the 39-month Post-Auction Transition Period, as soon as their licensed frequencies are vacated by any full power or Class A television stations that occupied those frequencies prior to the incentive auction. Because television stations transitioning to new channels or going off the air may be operating on different timetables under the rules established in the Incentive Auction R&O, there is a potential for inter-service interference between wireless providers that commence operations on

frequencies that have been vacated by a broadcast television station in their license area or in part of their license area and broadcast television stations in nearby markets that have not transitioned yet.

26. Accordingly, in the event that a wireless provider seeks to commence operations prior to the end of the 39-month Post-Auction Transition Period and there are co-channel or adjacent-channel broadcast television stations in the wireless licensee's downlink spectrum within the culling distances specified in OET-74, the Commission proposes to require the wireless provider to use OET-74 to predict whether wireless operations in its license area or part of its license area will cause harmful interference to the subject television stations. The wireless licensees would be required to retain the latest copy of the OET-74 study for each co-channel or adjacent-channel PEA license area where any of their base stations fall within the specified OET-74 culling distances and make it available to the Commission and to a subject television station upon request if there are complaints of interference either from a subject television station, a member of the public or the Commission. The Commission seeks comment on these proposals.

27. If there are co-channel or adjacent channel broadcast television stations in the wireless licensee's uplink spectrum that have not cleared their pre-auction channels, the Commission proposes to require the wireless providers to ensure that their user equipment does not operate in the contours and within five kilometers of the contour when co-channel or within a half kilometer when adjacent channel. The Commission seeks comment on this proposal.

Using the ISIX Methodology to Assess Interference from and to International Broadcast Television Stations During the Auction

28. The Commission has engaged in extensive discussions with Canada and Mexico to determine interference protection along the border areas. At this time, both Canada and Mexico are transitioning their broadcast services into digital in line with their regulatory requirements. Because the timing of these transitions is under the control of the administration of the respective countries, the

Commission seeks comment on using the ISIX Methodology and input values to identify impairments to wireless spectrum along the international borders during the auction.

29. As noted, the ISIX Methodology adopted in the companion Second Report & Order item is not designed for analog signals. As Canada and Mexico have not completed their digital transitions, the Commission also seeks comment on implementing an approach similar to that proposed above for predicting interference from analog LPTV to wireless service. Specifically, in predicting interference to and from foreign analog broadcast television stations along the international borders, it proposes to use TVStudy's capability to "replicate" an analog signal as an equivalent digital signal and analyze the station as though it was operating as digital.

INITIAL REGULATORY FLEXIBILITY ANALYSIS

30. As required by the Regulatory Flexibility Act (RFA),[1] the Commission has prepared this present Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on small entities by the policies and rules proposed in this Further Notice of Proposed Rule Making (FNPRM). Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines for comments provided on the first page of this FNPRM. The Commission will send a copy of this FNPRM, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).[2] In addition, the FNPRM and IRFA (or summaries thereof) will be published in the Federal Register.[3]

A. Need for, and Objectives of, the Proposed Rules.

31. The FNPRM addresses issues that arise from the Incentive Auction R&O to repurpose a portion of the broadcast spectrum for new wireless services and proposes rules governing the interference

[1] See 5 U.S.C. 603. The RFA, see 5 U.S.C. 601 – 612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Public Law 104-121, Title II, 110 Stat. 857 (1996).

[2] See 5 U.S.C. 603(a).

[3] See id.

in the 600 MHz Band following the incentive auction.[4] In the Incentive Auction R&O, the Commission adopted a flexible band plan framework that accommodates market variation.[5] Market variation occurs where broadcast stations remain on spectrum that is repurposed for wireless broadband under the 600 MHz Band Plan.[6] The FNPRM proposes rules for the protection of broadcast services from wireless operations in the 600 MHz Band when co-channel or adjacent channel and for the protection of wireless license areas from broadcast television stations seeking to expand their contours. It proposes a methodology in OET Bulletin No. 74 for predicting when a wireless base station will cause interference to a broadcast station. It proposes to require wireless user equipment to operate outside of certain separation distances from the broadcast station contours to avoid interference to television reception. In the event that wireless operations actually cause harmful interference to television reception in the 600 MHz Band where interference was not predicted to occur, the FNPRM proposes to require wireless providers to take action to eliminate the interference. The FNPRM seeks comment on appropriate wireless licensee obligations, both with respect to technical requirements and service rules. The FNPRM also proposes to adopt the ISIX Methodology to predict whether LPTV or TV Translators will cause interference to a wireless system in the 600 MHz Band. The FNPRM also proposes use of the ISIX Methodology and inputs, as detailed in the proposed OET-74, for ensuring that wireless services that are deployed during the 39-month transition period do not cause interference to broadcast television stations that have not yet transitioned to their final channel assignments.

B. Legal Basis.

32. The proposed action is authorized under sections 1, 4, 301, 303, 307, 308, 309, 310, 316, 319, 332, and 403 of the Communications Act of 1934, as amended, and sections 6004, 6402, 6403, 6404, and

[4] See Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket No. 12-268, Report and Order, 29 FCC Rcd 6567 (2014) (Incentive Auction R&O).

[5] Incentive Auction R&O, 29 FCC Rcd at 6605, para. 82 (discussing how the 600 MHz Band Plan can accommodate market variation to avoid restricting the amount of repurposed spectrum that is available in most areas nationwide).

[6] See Incentive Auction R&O, 29 FCC Rcd at 6604-6607, paras. 81-87.

6407 of Middle Class Tax Relief and Job Creation Act of 2012, Public Law 112-96, 126 Stat. 156, 47 U.S.C. 151, 154, 301, 303, 307, 308, 309, 310, 316, 319, 332, 403, 1404, 1452, and 1454.

C. Description and Estimate of the Number of Small Entities To Which the Proposed Rules Will Apply.

33. The RFA directs agencies to provide a description of and, where feasible, an estimate of the number of small entities that may be affected by the proposed rules, if adopted.[7] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[8] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[9] A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.[10]

34. Television Broadcasting. This economic census category "comprises establishments primarily engaged in broadcasting images together with sound. These establishments operate television broadcasting studios and facilities for the programming and transmission of programs to the public."[11] The SBA has created the following small business size standard for Television Broadcasting firms: those having $38.5 million or less in annual receipts.[12] The Commission has estimated the number of licensed commercial television stations to be 1,388.[13] In addition, according to Commission staff review of the BIA Advisory Services, LLC's Media Access Pro Television Database on March 28, 2012, about 950 of

[7] 5 U.S.C. 603(b)(3).

[8] 5 U.S.C. 601(6).

[9] 5 U.S.C. 601(3) (incorporating by reference the definition of "small business concern" in 15 U.S.C. 632). Pursuant to the RFA, the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register." 5 U.S.C. 601(3).

[10] Small Business Act, 15 U.S.C. 632 (1996).

[11] U.S. Census Bureau, 2012 NAICS Definitions: 515120 Television Broadcasting, http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=515120&search=2012 (last visited Mar. 6, 2014).

[12] 13 CFR 121.201 (NAICS code 515120) (updated for inflation in 2010).

[13] See FCC News Release, Broadcast Station Totals as of December 31, 2013 (rel. Jan. 8, 2014), http://transition.fcc.gov/Daily_Releases/Daily_Business/2014/db0108/DOC-325039A1.pdf.

an estimated 1,300 commercial television stations (or approximately 73 percent) had revenues of $38.5 million or less.[14] We therefore estimate that the majority of commercial television broadcasters are small entities.

35. We note, however, that in assessing whether a business concern qualifies as small under the above definition, business (control) affiliations must be included.[15] Our estimate, therefore, likely overstates the number of small entities that might be affected by our action because the revenue figure on which it is based does not include or aggregate revenues from affiliated companies. In addition, an element of the definition of "small business" is that the entity not be dominant in its field of operation. We are unable at this time to define or quantify the criteria that would establish whether a specific television station is dominant in its field of operation. Accordingly, the estimate of small businesses to which rules may apply does not exclude any television station from the definition of a small business on this basis and is therefore possibly over-inclusive to that extent.

36. In addition, the Commission has estimated the number of licensed noncommercial educational ("NCE") television stations to be 395.[16] These stations are non-profit, and therefore considered to be small entities.[17]

37. There are also 2,414 LPTV stations, including Class A stations, and 4,046 TV translator stations.[18] Given the nature of these services, we will presume that all of these entities qualify as small entities under the above SBA small business size standard.

38. Radio and Television Broadcasting and Wireless Communications Equipment

[14] We recognize that BIA's estimate differs slightly from the FCC total given the information provided above.

[15] "[Business concerns] are affiliates of each other when one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both." 13 CFR 121.103(a)(1).

[16] See FCC News Release, Broadcast Station Totals as of December 31, 2013 (rel. Jan. 8, 2014), http://transition.fcc.gov/Daily_Releases/Daily_Business/2014/db0108/DOC-325039A1.pdf.

[17] See generally 5 U.S.C. 601(4), (6).

[18] See FCC News Release, Broadcast Station Totals as of December 31, 2013 (rel. January 8, 2014), http://transition.fcc.gov/Daily_Releases/Daily_Business/2014/db0108/DOC-325039A1.pdf.

Manufacturing. The Census Bureau defines this category as follows: "This industry comprises establishments primarily engaged in manufacturing radio and television broadcast and wireless communications equipment. Examples of products made by these establishments are: transmitting and receiving antennas, cable television equipment, GPS equipment, pagers, cellular phones, mobile communications equipment, and radio and television studio and broadcasting equipment." The SBA has developed a small business size standard for Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing, which is: all such firms having 750 or fewer employees. According to Census Bureau data for 2007, there were a total of 939 establishments in this category that operated for part or all of the entire year. Of this total, 912 had less than 500 employees and 17 had more than 1000 employees. Thus, under that size standard, the majority of firms can be considered small.

39. Audio and Video Equipment Manufacturing. The SBA has classified the manufacturing of audio and video equipment under in NAICS Codes classification scheme as an industry in which a manufacturer is small if it has less than 750 employees. Data contained in the 2007 U.S. Census indicate that 492 establishments operated in that industry for all or part of that year. In that year, 488 establishments had fewer than 500 employees; and only 1 had more than 1000 employees. Thus, under the applicable size standard, a majority of manufacturers of audio and video equipment may be considered small.

40. Wireless Telecommunications Carriers (except satellite). The Census Bureau defines this category as follows: "This industry comprises establishments engaged in operating and maintaining switching and transmission facilities to provide communications via the airwaves. Establishments in this industry have spectrum licenses and provide services using that spectrum, such as cellular phone services, paging services, wireless Internet access, and wireless video services."[19] The appropriate size standard under SBA rules is for the category Wireless Telecommunications Carriers (except Satellite). The size

[19] U.S. Census Bureau, 2012 NAICS Definitions: 517210 Wireless Telecommunications Carriers (except Satellite), http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=517210&search=2012 (last visited Mar. 6, 2014).

standard for that category is that a business is small if it has 1,500 or fewer employees.[20] For this category, census data for 2007 show that there were 1,383 firms that operated for the entire year.[21] Of this total, 1,368 firms had employment of 999 or fewer employees and 15 had employment of 1000 employees or more.[22] Similarly, according to Commission data, 413 carriers reported that they were engaged in the provision of wireless telephony, including cellular service, PCS, and Specialized Mobile Radio ("SMR") Telephony services.[23] Of these, an estimated 261 have 1,500 or fewer employees and 152 have more than 1,500 employees.[24] Consequently, the Commission estimates that approximately half or more of these firms can be considered small. Thus, using available data, we estimate that the majority of wireless firms can be considered small.

D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements

41. This FNPRM proposes to establish the following reporting, recordkeeping, and compliance requirements. All wireless providers that hold licenses to operate co-channel or adjacent channel to a television station would perform an interference analysis using the methodology in OET-74 prior to deploying a base station within the set culling distance. The rule proposes that wireless licensees retain the latest copy of its interference analysis for each co-channel or adjacent channel Partial Economic Area (PEA) license area where any of its base stations fall within the specified OET-74 culling distances and make the analysis available to the Commission or a subject television station upon request in cases where there are complaints of interference from either the subject television station, a station viewer or the Commission. In addition, in the event that a television station and a 600 MHz Band wireless licensee do not reach resolution of an interference complaint, this FNPRM proposes that they can submit a claim of

[20] 13 CFR 121.201 (NAICS code 517210).

[21] U.S. Census Bureau, Table No. EC0751SSSZ5, Information: Subject Series - Establishment and Firm Size: Employment Size of Firms for the United States: 2007 (NAICS code 517210), http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_51SSSZ5.

[22] Id. Available census data do not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is for firms with 1000 employees or more.

[23] See Trends in Telephone Service at Table 5.3.

[24] See id.

harmful interference to the Commission. This FNPRM also proposes that when a 600 MHz Band wireless licensee files a construction notification, it use the ISIX Methodology for certain interference cases and the methodology in proposed OET Bulletin 74 in another interference case to demonstrate that it cannot serve its entire PEA service area, among other evidence. This FNPRM also tentatively concludes that broadcast licensees who operate in the 600 MHz Band can demonstrate non-interference to a wireless licensee's service area by showing that a proposed modification will not expand its contour in the direction of a co-channel or adjacent channel wireless licensee. This FNPRM also proposes that, in the event that a wireless provider seeks to commence operations prior to the end of the 39-month transition period and there are co-channel or adjacent-channel broadcast television stations in the wireless licensee's downlink spectrum within the culling distances specified in OET-74, the wireless provider will use OET-74 to predict whether its operations will cause harmful interference to the subject television stations. This FNPRM proposes to require the wireless licensee to retain the latest copy of the OET-74 study and make it available to the Commission and to a subject television station upon request if there are complaints of interference either from a subject television station, a member of the public, or the Commission.

E. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered

42. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.[25]

43. The proposed reporting, recordkeeping, and compliance requirements will apply to all

[25] See 5 U.S.C. 603(c).

entities in the same manner. The Commission believes that applying the same rules equally to all entities in this context promotes fairness. The Commission does not believe that the costs and/or administrative burdens associated with the rules will unduly burden small entities. Wireless providers may use either the Commission's TVStudy software available for free online at http://data.fcc.gov/download/incentive-auctions/OET-69/ or their own network planning software in which they can incorporate the Longley-Rice Fortran Code included with the TVStudy source code, to perform the OET-74 analysis.

F. Federal Rules that May Duplicate, Overlap, or Conflict With the Proposed Rule

44. None.

PROCEDURAL MATTERS

Paperwork Reduction Act Analysis

45. This FNPRM contains proposed information collection requirements. The Commission, as part of its continuing effort to reduce paperwork burdens, invites the general public and the Office of Management and Budget (OMB) to comment on the information collection requirements contained in this document, as required by the Paperwork Reduction Act of 1995, Public Law 104-13. In addition, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, see 44 U.S.C. 3506(c)(4), the Commission seeks specific comment on how it might further reduce the information collection burden for small business concerns with fewer than 25 employees.

ORDERING CLAUSES

46. Pursuant to the authority found in sections 1, 4, 301, 303, 307, 308, 309, 310, 316, 319, 332, and 403 of the Communications Act of 1934, as amended, and sections 6004, 6402, 6403, 6404, and 6407 of Middle Class Tax Relief and Job Creation Act of 2012, Public Law 112-96, 126 Stat. 156, 47 U.S.C. 151, 154, 301, 303, 307, 308, 309, 310, 316, 319, 332, 4031404, 1452, and 1454, and 1.2 of the Commission's rules, 47 CFR 1.2, the Second Report and Order and Further Notice of Proposed Rule Making **IS ADOPTED**.

47. The Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, **SHALL SEND** a copy of this Second Report and Order and Further Notice of Proposed Rulemaking in GN Docket No. 12-268, including the Initial Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

List of Subjects in 47 CFR part 27 and 73

Communications equipment, Reporting and recordkeeping requirements.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary.

For the reasons discussed in the preamble, the Federal Communications Commission proposes to amend 47 CFR parts 27 and 73 as follows:

PART 27 – MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES

1. The authority citation of part 27 continues to read as follows:

Authority: 47 U.S.C. 154, 301, 302(a), 303, 307, 309, 332, 336, 337, 1403, 1404, 1451, and 1452 unless otherwise noted.

2. Section 27.1310 is added to read as follows:

Subpart N – 600 MHz Band

§ 27.1310 Protection of Broadcast Television Service in the 600 MHz Band from Wireless Operations.

(a) Licensees authorized to operate wireless services in the 600 MHz band must cause no harmful interference to public reception of the signal of broadcast television stations transmitting co-channel or on the adjacent channel.

(1) Such wireless operations must comply with the D/U ratios in Tables 7-13 in OET Bulletin No. 74. Copies of OET Bulletin No. 74 may be inspected during normal business hours at the Federal Communications Commission, 445 12th St., SW, Reference Information Center (Room CY A257), Washington, DC 20554. This document is also available through the Internet on the FCC Home Page at http://www.fcc.gov.

(2) If the 600 MHz band licensee causes harmful interference to the public reception of a signal of a broadcast television station that is operating co-channel or on an adjacent channel, that licensee must eliminate the harmful interference.

(b) Licensees authorized to operate wireless services in the 600 MHz band:

(1) Are not permitted to deploy wireless base stations within noise-limited service contour or protected contour of a broadcast television station licensed on a co-channel or adjacent channel in the 600 MHz Band, and

(2) Are required to perform studies to evaluate the potential for their operations to cause harmful interference to public reception of the signal of such broadcast television station using the methodology in OET Bulletin No. 74 when they intend to deploy wireless base stations within the culling distances from the noise-limited contour or protected contour of a broadcast television station licensed on a co-channel or adjacent channel in the 600 MHz band specified in OET Bulletin No. 74. Licensees shall maintain records of those studies and make them available for inspection upon a claim of harmful interference to the requesting broadcasting television station or the Commission.

(c) Mobile and portable devices that operate in the 600 MHz band shall afford protection to co-channel and adjacent channel broadcast television stations in the following manner:

(1) By maintaining a minimum distance of 5 kilometers (3 miles) from co-channel broadcast television station noise-limited service or protected contours.

(2) By maintaining a minimum distance of 500 meters from adjacent-channel broadcast television station noise-limited service or protected contours (3) by not operating within the contours of a broadcast television station that is operating co-channel or adjacent channel.

(3) Licensees authorized to operate wireless services in the 600 MHz band may meet the requirements of this subparagraph by limiting their coverage to areas at least the distance prescribed by paragraphs (c)(1) through (3) outside all noise-limited service or protected contours from co-channel or adjacent broadcast television stations.

(d) For purposes of this section, broadcast television station is defined pursuant to §73.3700(a)(1) of this chapter.

(e) For purposes of this section, co-channel operations in the 600 MHz band are defined as operations of broadcast television stations and wireless services where their assigned channels spectrally overlap.

Adjacent channel operations are defined as operations of broadcast television stations and wireless services where their assigned channels spectrally abut each other or are separated by up to 5 MHz.

PART 73 – RADIO BROADCAST SERVICES

3. The authority citation of part 73 continues to read as follows:

Authority: 47 U.S.C. 154, 303, 334, 336, and 339.

4. Sections 73.3700 is amended by adding paragraph (i) to read as follows:

§ 73.3700 Post-incentive auction aicensing and operation.

* * * * *

(i) A broadcast television station licensed in the 600 MHz band, as that is defined in § 27.57(l),

(1) Shall not be permitted to modify its facilities, if such modification will expand the noise limited service contour of a full power station or the protected contour of a Class A station in the direction of a wireless license area which is co-channel or adjacent channel to the broadcast television station;

(2) May request a waiver of paragraph (a), if

(i) A modification of the facilities is caused by extraordinary circumstances outside the broadcast television station's control, or

(ii) The broadcast television station cannot replicate its service area on the reassigned channel following the publication of the Channel Reassignment Public Notice.

PROPOSED OET BULLETIN No. 74

LONGLEY-RICE METHODOLOGY FOR

PREDICTING INTER-SERVICE INTERFERENCE TO

BROADCAST TELEVISION FROM MOBILE WIRELESS

BROADBAND SERVICES IN THE UHF BAND

I. INTRODUCTION

This Bulletin provides the methodology for prediction of interference from fixed wireless base stations in the 600 MHz downlink spectrum to digital full-power and Class A television service areas that operate co-channel or adjacent-channel to mobile wireless broadband operations. The methodology provides guidance on the implementation and use of the NTIA Institute for Telecommunications Science's Longley-Rice radio propagation model for predicting inter-service interference (ISIX) to broadcast television from mobile wireless broadband services. For broadcast television, this methodology assumes use of the Advanced Television Systems Committee's (ATSC) Digital Television (DTV) Standard, although it is possible, especially across U.S. international borders, that the National Television Systems Committee (NTSC) analog Television (TV) standard may also be used. Consideration of interference predictions from fixed wireless base stations to analog television service areas is outside of the scope of this Bulletin.

The methodology uses the Longley-Rice model for predicting field strength at receive points based on the elevation profile of terrain between the transmitter and each specific reception point. The methodology described in this Bulletin generates predictions over large areas using the broadcast mode. For practical reasons, a computer is needed to make these predictions because of the large amount of data required for each calculation. Computer code for Version 1.2.2 of the Longley-Rice radio propagation model (Longley-Rice model) is available at http://www.its.bldrdoc.gov/resources/radio-propagation-software/itm/itm.aspx.

II. EVALUATION OF SERVICE

The service areas subject to interference calculation are defined in the FCC rules for both digital full-power and Class A television stations; the rules also specify standards for determining interference to DTV service. Because wireless services are expected to be noise-like and studies have shown that noise-like signals have interference potential nearly identical to DTV, interference protection criteria similar to those currently used for DTV-to-DTV can generally be applied with some adjustments as discussed below.

For digital full-power television stations, service is evaluated inside the noise-limited contour defined in 47 CFR 73.622(e) with the exception that the defining field strength threshold for UHF channels is modified by subtracting a frequency-dependent dipole antenna adjustment factor. Thus, the area subject to interference calculation for digital full-power TV stations consists of the area within the contours described by the geographic points at which the field strength predicted for 50% of locations and 90% of the time by FCC curves is at least as great as $41 - 20\log_{10}[615/(\text{channel mid-frequency in MHz})]$.

For digital Class A TV stations, service is protected only inside the "protected contour" defined in 47 CFR 73.6010(c), with the exception that the defining field strength threshold for UHF channels is modified by subtracting a frequency-dependent dipole antenna adjustment factor. Thus, the area subject to interference calculation for digital Class A TV stations consists of the area within the contours described by the geographic points at which the field strength predicted for 50% of locations and 90% of time by FCC curves is at least as great as $51 - 20\log_{10}[615/(\text{channel mid-frequency in MHz})]$.

The service area subject to interference calculation is divided into trapezoidal cells approximately 2 kilometers on a side across a global grid. The Longley-Rice propagation model Version 1.2.2 is applied between the DTV transmitter site and a point in each cell to determine whether the predicted desired field strength is above the values identified above, for each digital full-power or Class A TV station, respectively, based on the TV station's operating channel. For cells with population, the point chosen is the population centroid, as determined using the method implemented in the FCC's TVStudy software

implementing the Longley-Rice model – otherwise the point chosen is the geometric center of the cell and the point so determined represents the entire cell in all subsequent service and interference calculations. The station's directional transmitting antenna patterns (azimuth and elevation), if applicable, are taken into account in determining the effective radiated power (ERP) in the direction of each cell.

Longley-Rice parameter settings for the calculations specified in this Bulletin are shown in table below.

Parameter	Value	Meaning/Comment
EPS	15.0	Relative permittivity of ground.
SGM (S/m)	0.005	Ground conductivity.
ZSYS	0.0	General System Elevation. Coordinated with setting of EN0.
EN0 (ppm)	301.0	Surface refractivity in N-units.
IPOL	0	Denotes horizontal polarization.
MDVAR	3	Calculation Mode (Broadcast).
KLIM	5	Climate Code (Continental Temperate).
XI (km)	0.1	Terrain sampling interval.
HG(1) (m)	30	Height of the radiation center above ground.
HG(2) (m)	10	Height of DTV receiver above ground.
Time variability (desired signal)	90%	
Time variability (undesired signal)	10%	
Location variability	50%	
Confidence variability	50%	(Also called situational variability)
Error Code (KWX = 3)	Ignore	Accept the path loss value that is returned by Longley-Rice code.

Note: HG(1) is the height of the wireless transmitting antenna radiation center above ground at its specific geographic coordinates, which may be determined by subtracting the ground elevation above mean sea level (AMSL) at the transmitter location from the height of the antenna radiation center AMSL. However, if ground elevation is retrieved from the terrain elevation database as a function of the transmitter site coordinates, then bilinear interpolation between the surrounding data points in the terrain database shall be used to determine the ground elevation. Care should be used to ensure that consistent horizontal and vertical datums are employed among all data sets.

III. EVALUATION OF INTERFERENCE

A. Application of the Longley-Rice Model to Determine Interfering Signal Strength

The presence or absence of interference in each grid cell of the area subject to calculation is determined by further application of the Longley-Rice model. Radio paths between undesired transmitters and each global 2-kilometer grid point inside the service area are examined. The undesired transmitters included in the analysis of each cell are those which are possible sources of interference at that cell, considering their distance from the cell and frequency relationships. For each such radio path, the Longley-Rice model is applied for median situations (that is, confidence 50%), for 50% of locations, 10% of the time for the prediction of potential interference to TV receivers. In those cases that error code 3 occurs, the predicted interfering field strength nevertheless is to be accepted in determining whether there is interference at that location.

B. Areas of Potential Interference

To determine whether the placement of a wireless base station at a particular location would cause interference to any TV station, information about each site in a planned wireless base station deployment is required. Specifically, actual values are required for:

- effective radiated power (ERP),
- geographic location, and
- antenna height above average terrain (HAAT)

The wireless transmit antennas may conservatively be assumed to be non-directional in both the azimuth and elevation directions, as these may be simpler to implement. However, actual antenna azimuth and elevation patterns for each planned wireless base station site may be used for increased accuracy by importing these patterns into the software implementing the Longley-Rice model and setting the azimuth orientation (N ° E, T) on a site-by-site basis.

The interference analysis for TV reception examines only those cells across the global 2-kilometer grid within the area subject to calculation that have already been determined to have a desired

field strength above the threshold for reception referenced above in Section II, as appropriate. A cell on the global 2-kilometer grid is counted as receiving interference to TV if the ratio of the desired field to that of the square root of the sum of the squares (root-sum-square, or RSS) of all of an individual wireless licensee's undesired wireless interference sources within the appropriate culling distances, defined below, is less than the minimum D/U threshold value for the corresponding spectral overlap between the TV and wireless channels. The comparison is made after applying the discrimination effect of the receiving TV antenna.

C. DTV D/U Ratios for Co-Channel and Adjacent Channel Operations

Thresholds of interference using the ratio of desired to undesired field strength to protect DTV reception from wireless co-channel interference are computed from the following formula:

$$\text{Wireless-into-DTV D/U} = 15 + \Delta + \alpha - \text{OFR} \qquad \text{(Eq. 1)}$$

Where:

$$\Delta = \begin{cases} 1 & \text{co-channel (spectral overlap } > 0 \text{ MHz)} \\ 0 & \text{adjacent-channel (spectral overlap } \leq 0 \text{ MHz)} \end{cases}$$

$$\propto = 10Log_{10}\left[\frac{1}{\left(1-10^{-x/10}\right)}\right] \text{x = S/N – 15.19 dB}$$

OFR = Off-frequency rejection (see Table 4)

Because a 5 MHz wireless channel and a 6 MHz DTV channel may not always fully overlap, the total wireless power in the TV channel is a function of the degree of spectral overlap, expressed in integer megahertz (MHz). In Table 1, a fully co-channel scenario would correspond to 5 MHz of transmitter/receiver overlap, while a first-adjacent situation would correspond to 0 MHz of overlap. Partial co-channel overlaps correspond to values of 1, 2, 3, and 4 MHz. Negative overlap values define the amount of frequency separation between channel edges in the adjacent-channel cases. The co-channel values at 5 MHz may be used where there is more than 5 MHz of overlap. Wireless operations with frequency separations more than 5 MHz between channel edges or distance separations greater than the culling distances beyond a DTV station's noise-limited or protected contour, for full-power and Class A stations, respectively, are not evaluated for interference because the probability of interference beyond

those values for each height and/or power combination specified in Table 3 through Table 9 below is unlikely.

Overlap in MHz / OFR (dB)	5	4	3	2	1	0	-1	-2	-3	-4	-5
Downlink into DTV	0	0.9	2.2	3.9	6.7	17.0	33	33	33	33	33

Table 1. Calculated off-frequency rejection (OFR) values for wireless base station into DTV

The values for off-frequency rejection (OFR) were derived using NTIA's MSAM FDR computer program using FCC's emission limits, and DTV receiver performance standards published by ATSC for the first-adjacent channel.

To protect DTV reception from wireless downlink interference at various degrees of spectral overlap, the minimum threshold D/U ratios are shown in Table 2. These were derived using Equation 1 and the OFR values from Table 1. Values of α vary for each cell and are determined by the predicted desired field strength in each cell, the DTV planning factors, and the S/N of Equation 2.

Spectral Overlap (MHz)	5	4	3	2	1	0	-1 to -5
Downlink into DTV D/U Required (dB)	16.0 + α	15.1 + α	13.8 + α	12.1 + α	9.3 + α	-2.0 + α	-18 + α

Table 2. Threshold interfering D/U ratios for wireless base station into DTV

D. DTV Planning Factors

The field strength values identified in Section II define the area subject to interference calculations for full-power and Class A UHF DTV stations, respectively. These field strengths are based on the DTV planning factors for UHF provided in OET Bulletin No. 69, which are assumed to characterize the equipment, including antenna systems, used for consumer reception at fixed locations. They determine the minimum field strength for DTV reception in the UHF band.

For UHF, the dipole adjustment factor, $K_a = 20\log_{10}[615/(\text{channel mid-frequency in MHz})]$, is added to K_d in each case to account for the fact that field strength requirements are greater for UHF channels above the geometric mean frequency of the historically defined UHF TV band (*i.e.*, channels 14-

69) and smaller for UHF channels below that mean frequency. The geometric mean frequency, 615 MHz, is approximately the mid-frequency of TV channel 38. By applying the planning factors and using the Longley-Rice model to predict the desired field strength "E," the predicted signal-to-noise ratio (S/N) is then calculated from the formula:

$$S/N = E + K_d + K_a + G - L - N_t - N_s \quad \text{(Eq. 2)}$$

The predicted S/N value associated with the field strength of the desired signal in each cell is used, based on the TV station's operating channel, to determine the applicable interference threshold using Table 2 and the planning factors.

E. DTV Receiving Antenna Pattern

The TV receiving antenna is assumed to have a directional gain pattern which tends to discriminate against off-axis undesired stations. This pattern is a planning factor affecting the receiver's susceptibility to interference. A working group of the FCC Advisory Committee for Advanced Television Service chose the specific form of this pattern. The discrimination, in relative field, provided by the assumed TV receiving pattern is a fourth-power cosine function of the angle between the lines joining the desired and undesired stations to the reception point. One of these lines goes directly to the desired station, the other goes to the undesired station. The discrimination is calculated as the fourth power of the cosine of the angle between these lines but never more than represented by the front-to-back ratio of 14 dB for UHF. When both desired and undesired stations are on the receive antenna's boresight, the angle is 0.0 giving a cosine of unity so that there is no discrimination. When the undesired station is somewhat off-axis, the cosine will be slightly less than unity and the resulting interference field strength is reduced accordingly by this value (while the desired field strength remains unchanged); when the undesired station is far off-axis, the maximum discrimination given by the 14 dB front-to-back ratio is attained, and the resulting interference field strength is reduced by 14 (while the desired field strength still remains unchanged).

F. Identification of Potentially Interfering Stations

Potential sources of interference are identified as a function of distance for the given ERP, HAAT, and frequency relationship in terms of spectral overlap of each site in a planned wireless deployment. Spectral overlap is defined as the frequency separation between channel edges of a wireless block and DTV channel. For wireless bandwidths larger or smaller than 5 MHz, interference evaluations need only consider the separation between the occupied portions of each 5 MHz block.

The interference analysis is performed independently for each cell in the DTV service area subject to calculation. Only those wireless base stations with transmitter sites at distances less than the culling distance (corresponding to the wireless base station ERP, HAAT, and spectral overlap) from the edge of a DTV station noise-limited or protected contour are to be considered in the interference analysis. Table 3 through Table 9 specify these culling distances, which were derived based on the distance to the UHF F(50,10) {OFR (dB) + 18} dBμV/m contour, depending on the OFR for each spectral overlap case.

HAAT	ERP (kW) per 5 MHz block:								
(m):	5	4	3	2	1	0.75	0.5	0.25	0.1
305	209	204	196	186	169	163	153	136	115
200	197	191	183	174	158	151	141	125	104
150	190	184	178	168	152	145	135	119	98
100	183	178	171	160	144	137	127	111	91
80	180	174	166	156	140	133	123	107	86
65	176	170	163	153	137	130	120	104	83
50	172	167	159	150	133	126	117	100	80
35	168	162	155	145	129	122	113	97	76

Table 3. Culling distances (in km) from DTV noise-limited or protected contour (spectral overlap ≥ 5 MHz)

HAAT	ERP (kW) per 5 MHz block:								
(m):	5	4	3	2	1	0.75	0.5	0.25	0.1
305	205	199	192	181	166	159	148	132	111
200	192	186	179	169	153	146	137	121	100
150	185	180	173	164	147	140	131	115	94
100	179	173	166	156	139	132	123	107	86
80	175	169	162	152	136	128	119	103	82
65	171	166	158	149	132	125	116	99	79
50	168	162	155	146	129	122	112	96	76
35	163	158	151	141	125	118	108	92	73

Table 4. Culling distances (in km) from DTV noise-limited or protected contour (spectral overlap = 4 MHz)

HAAT	ERP (kW) per 5 MHz block:								
(m):	5	4	3	2	1	0.75	0.5	0.25	0.1
305	197	191	183	173	158	150	141	124	104
200	183	178	171	162	146	139	129	113	93
150	178	172	166	156	140	133	123	108	87
100	171	165	158	149	131	124	116	100	79
80	167	161	154	145	127	121	112	96	75
65	163	158	151	142	125	118	108	92	73
50	159	154	148	138	121	114	105	89	70
35	155	150	143	133	117	110	101	85	66

Table 5. Culling distances (in km) from DTV noise-limited or protected contour (spectral overlap = 3 MHz)

HAAT	ERP (kW) per 5 MHz block:								
(m):	5	4	3	2	1	0.75	0.5	0.25	0.1
305	187	181	174	166	148	141	132	116	97
200	174	170	163	153	137	130	121	105	86
150	169	164	157	147	131	124	115	99	80
100	161	156	149	140	123	116	107	91	73
80	157	152	146	136	119	112	103	87	69
65	154	149	143	132	116	109	100	84	66
50	151	146	139	129	112	105	96	81	63
35	146	141	134	125	108	102	92	77	60

Table 6. Culling distances (in km) from DTV noise-limited or protected contour (spectral overlap = 2 MHz)

HAAT	ERP (kW) per 5 MHz block:								
(m):	5	4	3	2	1	0.75	0.5	0.25	0.1
305	171	166	160	149	133	126	116	102	87
200	159	154	147	138	121	115	105	91	75
150	153	148	141	131	116	109	100	85	69
100	146	140	133	123	108	101	92	77	63
80	142	136	129	120	104	97	88	73	60
65	139	133	126	116	100	94	84	71	57
50	135	130	123	113	97	90	81	67	54
35	131	125	119	109	93	87	78	64	51

Table 7. Culling distances (in km) from DTV noise-limited or protected contour (spectral overlap = 1 MHz)

HAAT (m):	ERP (kW) per 5 MHz block:								
	5	4	3	2	1	0.75	0.5	0.25	0.1
305	115	110	104	97	86	82	76	68	59
200	104	99	93	85	73	70	65	59	52
150	98	93	87	79	68	65	61	55	48
100	90	85	79	72	62	59	55	49	42
80	86	81	75	69	59	56	52	46	38
65	83	78	73	66	56	53	49	43	36
50	80	75	70	62	53	50	46	40	33
35	76	72	66	59	50	46	42	35	28

Table 8. Culling distances (in km) from DTV noise-limited or protected contour (spectral overlap = 0 MHz)

HAAT (m):	ERP (kW) per 5 MHz block:								
	5	4	3	2	1	0.75	0.5	0.25	0.1
305	61	59	57	53	48	46	43	37	31
200	53	52	50	47	42	39	37	32	26
150	49	48	46	42	37	35	32	28	23
100	43	42	39	37	32	30	27	23	18
80	40	38	36	33	29	27	25	21	16
65	37	36	34	31	26	25	22	18	14
50	34	33	30	28	23	22	19	15	12
35	29	28	26	23	19	17	15	13	10

Table 9. Culling distances (in km) from DTV noise-limited or protected contour (spectral overlap $< 0, \geq -5$ MHz)

G. Engineering Databases

DTV Engineering Data. Engineering data for TV stations in the U.S. (including full-power DTV and Class A) is available from the FCC. Data for individual stations can be found at http://www.fcc.gov/mb/video/tvq.html, and consolidated data for all authorized stations can be found at ftp://ftp.fcc.gov/pub/Bureaus/MB/Databases/cdbs/. Where more than one authorization exists for a particular station, the record associated with the facility actually operating shall be used. Where specific elevation pattern data are not provided in the engineering data, a generic elevation pattern may be used as described generally in OET Bulletin No. 69 or in the rules. The generic elevation pattern should, however, be offset by the amount of electrical beam tilt specified in the CDBS.

[FR Doc. 2014-29688 Filed 12/19/2014 at 8:45 am; Publication Date: 12/22/2014]