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FEDERAL COMMUNICATIONS COMMISSION

47 CFR Parts 73

[ET Docket No. 13-26 and GN 12-268; DA 13-138]

Office of Engineering and Technology Seeks Comment on Updated OET-69 Software

AGENCY: Federal Communications Commission.

ACTION: Proposed rule.

SUMMARY: The FCC's Office of Engineering and Technology (OET) announced the release of new software to perform interference analyses using the methodology described in its Bulletin No. 69 (OET-69). This software, called TVStudy, provides analysis of coverage and interference of full-service digital and Class A television stations. The Commission plans to use this new software in connection with the proposed broadcast television spectrum incentive auction (incentive auction). OET seeks comment on the software generally, as well as the identification of any errors, unexpected behaviors, or anomalous results produced in running the software. In addition, OET solicits comment on the implementation of various analytical elements in the software that are not specifically addressed in OET-69.

DATES: Comments must be filed on or before **March 21, 2013** and reply comments must be filed on or before **April 5, 2013.**

FOR FURTHER INFORMATION CONTACT: Robert Weller, Office of Engineering and Technology, (202) 418-7397, e-mail: Robert.Weller@fcc.gov, TTY (202) 418-2989.

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

- Federal Communications Commission's Web Site: http://fjallfoss.fcc.gov/ecfs2/. Follow the instructions for submitting comments.
- Mail: Robert Weller, Office of Engineering and Technology, Room 7-A134, Federal Communications Commission, 445 12th SW, Washington, DC 20554.

- People with Disabilities: Contact the FCC to request reasonable accommodations (accessible format documents, sign language interpreters, CART, etc.) by e-mail: fcc504@fcc.gov or phone: 202-418-0530 or TTY: 202-418-0432.

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

SUPPLEMENTARY INFORMATION: This is a summary of the Public Notice ET Docket No. 13-26 and GN Docket No. 12-268, DA 13-138 released February 4, 2013. 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 sections 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 Public Notice

The FCC's Office of Engineering and Technology (OET) announced the release of new software to perform interference analyses using the methodology described in its Bulletin No. 69 (OET-69). This software, called TVStudy, provides analysis of coverage and interference of full-service digital and Class A television stations. The Commission plans to use this new software in connection with the proposed broadcast television spectrum incentive auction (incentive auction). OET seeks comment on the software generally, as well as the identification of any errors, unexpected behaviors, or anomalous results produced in running the software. In addition, OET solicits comment on the implementation of various analytical elements in the software that are not specifically addressed in OET-69.

Background

The Commission developed the software that is currently used to implement OET-69 to support the DTV transition, and it has subsequently been used to analyze applications to modify the DTV Table of Channel Allotments. As such, the software programs developed by the FCC for those purposes are based fundamentally on source code and data from the 1990s and earlier. Since that time, some of the underlying datasets have evolved or have been replaced. In addition, parties have gained sufficient experience to have offered FCC staff informal feedback on the existing programs' relative strengths and weaknesses.

It is with these matters in mind that we have developed the TVStudy software. The new software operates on modern computer systems, and it runs much faster, provides greater accuracy in modeling and analysis, and is easier to use and more versatile than the existing software. In addition, the TVStudy software will allow us to perform the types of analyses that are needed to support the proposed incentive auction.

An important component of the proposed incentive auction is the repacking of broadcast television stations, including the potential reassignment of stations to new operating channels. The Middle Class Tax Relief and Job Creation Act of 2012 (Spectrum Act) requires the Commission to "make all reasonable efforts to preserve, as of the date of the enactment of this Act, the coverage area and population served of each broadcast television licensee, as determined using the methodology described in OET Bulletin 69 of the Office of Engineering and Technology." OET-69 describes a methodology that divides the area within a digital television station's noise-limited coverage contour into approximately rectangular "grid cells," and then evaluates these cells for coverage and, where present, interference. The Commission's Incentive Auction NPRM, See Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, Notice of Proposed Rulemaking, FCC 12-118, Docket No. 12-268, 27 FCC Rcd. 12357 (2012) (Incentive Auction NPRM). Available at http://transition.fcc.gov/Daily_Releases/Daily_Business/2012/db1002/FCC-12-118A1.pdf

proposes to define the "coverage area" of full-power stations as the geographic area within a station's noise-limited contour where its signal strength is predicted to exceed the noise-limited service level, both levels calculated on an F(50,90) basis. Similarly, the Incentive Auction NPRM proposes to define the "coverage area" for Class A stations as the geographic area within a station's protected contour where its signal strength is predicted to exceed the protected service level, both levels calculated on an F(50,90) basis.

The Incentive Auction NPRM also proposes to define the "population served" by full-power stations as the population within a station's noise-limited contour where its signal strength is predicted to exceed the noise-limited service level on an F(50,90) basis and is not subject to predicted interference from other stations, using the protection ratios specified in OET-69 and the rules. Similarly, the Incentive Auction NPRM proposes to define the "population served" by Class A stations as the population within a station's protected contour where its signal strength is predicted to exceed the protected service level on an F(50,90) basis and is not subject to predicted interference from other stations, using the protection ratios specified in OET-69 and the rules.

OET-69 defines certain parameter values for programmers to use when developing the software to implement OET-69's methodology. In particular, Table 4 of OET-69 lists parameter values used by the Fortran Code for the Longley-Rice (L-R) radio signal propagation model used in the implementing software, Tables 5A and 5B list the D/U ratios to be used in predicting interference, Table 6 describes the performance of the assumed receiving antennas, and Table 8 describes the elevation-plane performance of the assumed transmitting antennas. The foregoing is not an exhaustive list; OET-69 provides additional definitions and guidance. OET-69 does not, however, specify all of the parameters and methods required when developing software to implement OET-69's methodology. The choices made in implementing the methodology of OET-69 can produce different results, and such differences can affect a station's coverage area and population served. By making the new TVStudy software as well as reference copies of the various databases necessary to run that software available to the public, we provide a means for

implementing the OET-69 methodology that ensures consistency in the results obtained by the Commission and interested parties.

TVStudy Software

The new TVStudy software is designed for making rapid coverage and interference calculations involving many stations and provides highly-detailed outputs. It is intuitive in its operation and rapidly produces useful results. It has been developed in two parts: 1) a graphical user interface (implemented in Java), used to establish the parameters of the study and which draws data from appropriate databases; and 2) an analysis engine (implemented in C), which makes the necessary calculations to establish coverage and interference. The outputs include both summaries of area and population by station, and detailed signal level predictions by cell.

We are interested in feedback that discusses the capabilities of the TVStudy software to support the incentive auction and to implement whatever decisions are made in the rulemaking proceeding. For example, one of the options discussed in the Incentive Auction NPRM requires identifying specific populations presently subject to interference so that new interference is not created. As a practical matter, such an approach requires maintaining a database of interference status at the cell level. The present software implementing OET-69 that the Commission uses for processing applications for new TV stations and modifications to existing stations does not support creation of such a database. The present software was designed for processing individual applications rather than the concurrent study of complete, nationwide assignments. We also seek comment on the new software generally as a tool for analyzing the service area coverage, population served, and interference received by broadcast television stations.

In developing the TVStudy software, we have identified various parameter choices consistent with but not specified in OET-69 that we believe are necessary for improved accuracy in our modeling and analysis. We incorporated "soft-switches" into the TVStudy software to permit the user to evaluate the effects of the different choices. We note that the different

parameter choices may yield results for both coverage and interference different from legacy versions of software that have been used in the past.

In conducting the proposed incentive auction, an important objective is that we use software with improved accuracy and that makes use of the best available data to compute estimates of the coverage area and population served of each broadcast television licensee consistent with the provisions of the Spectrum Act. To that end, we solicit feedback from stakeholders, experts, and others on the implementation of the TVStudy software. Specifically, we discuss below and invite comment in the following areas:

- Population data
- Terrain data
- Treatment of inaccurate data in FCC database
- Treatment of antenna beam tilt
- Calculation of depression angles
- Level of precision of geographic coordinates
- Establishment of calculation (cell) grid
- Treatment of internal (Longley-Rice) warnings

Population Data. Population coverage in the original DTV Table of Allotments was calculated using data from the 1990 U.S. Census. According to the U.S. Census, the population of the United States increased by about 24 percent between 1990 and 2010, and the distribution of population has also changed. Because the use of 1990 Census data in the present OET-69 software is unlikely to produce an accurate depiction of present-day DTV station population coverage, the TVStudy software is designed to use 2010 U.S. Census data.

Terrain Data. Three-arcsecond digital terrain data are used in the present OET-69 software that we used to develop the original DTV Table of Allotments. This means that land elevations are reported every three seconds of geographic latitude and longitude (about every 300

feet). The three-arcsecond database was produced primarily by automatically scanning and interpolating large-scale (such as 1:250,000) paper maps, which often used relatively coarse elevation contours. A number of versions of the three-arcsecond terrain database were released by various agencies, some of which contained errors. Moreover, the three-arcsecond terrain database is no longer being revised, maintained, or supported by the U.S. Geological Survey. A new one-arcsecond terrain database, which has greater resolution (elevation points are spaced about every 100 feet), has replaced the old three-arcsecond terrain database. Additionally, the one-arcsecond terrain database is derived from smaller-scale (e.g. 1:24,000) topographic maps with more granular elevation data, and the method for extracting elevation data from those maps has been improved. Because continued use of an unsupported terrain database is likely to lead to obsolescence and potentially inaccurate results, the TVStudy software is designed to use one-arcsecond terrain data.

Treatment of Inaccurate Data in FCC Database. We recognize that there may be instances where the information entered into the FCC's broadcast station database (CDBS) may not be fully accurate. Examples may include:

- Negative values for beam tilt
- Swapped values for mechanical beam tilt and orientation
- Missing maximum values for directional antenna patterns
- Missing or incorrect directional antenna flags
- ERP value entered in dBk instead of kilowatts

These sorts of inaccuracies can lead to incorrect or nonsensical results when used in a computer program to predict coverage and interference. We are not proposing to modify the information in the underlying CBDS database. However, we seek comment on what methods we should use to detect information that may be inaccurate and what correction methods we should incorporate into our use of that information.

Treatment of Antenna Beam Tilt. All DTV stations operate directionally in the elevation plane. That is, the transmitting antenna is engineered to focus energy toward populated areas while minimizing energy radiated skyward. To accomplish this, most transmitting antennas are tilted downward, usually uniformly (electrically) but sometimes non-uniformly (mechanically), or both. The actual amount of tilt, if any, is contained in the CDBS record for each station. The present software used to implement OET-69 uses elevation patterns with a fixed electrical beam tilt (e.g., 0.75° for full-power stations operating on UHF channels), and in the development of the original DTV Table of Allotments, the actual amount of tilt given in CDBS was ignored. As a result of ignoring the actual beam tilt, the direction of main beam radiation used to project coverage in the present software may be incorrect, which can effectively cause it to "miss" the population being served. We believe that a better practice in implementing OET-69 would be to use the value for electrical downtilt specified in CDBS to correct the generic elevation pattern such that the main beam is at the angle specified in CDBS rather than using a fixed value. Because sufficient information is typically not available to correctly project the antenna patterns of stations having mechanical beam tilt, we do not propose to use mechanical beam tilt in OET-69 calculations.

Calculation of Depression Angles. The depression angle is the vertical angle between the horizontal (at the location of the DTV transmitting antenna) and the location of the receive site under study (cell centroid). An error in the present software used to implement OET-69 and to develop the original DTV Table of Allotments caused this angle to be incorrectly calculated based on the antenna height above ground, rather than the height above mean sea level. This error can cause the radiated power toward the cell under study to be incorrectly calculated, particularly for stations that have antennas atop tall mountains (as opposed to tall towers). The TVStudy software is designed to avoid causing this error.

Precision of Geographic Coordinates. The fundamental unit of the U.S. Census is the Census Block, which specifies locations to a precision of 0.0000001° (about 0.0004 seconds) of

latitude and longitude. Earlier versions of software implementing OET-69 rounded or truncated this location data to the nearest second, discarding some three orders of precision. This action often causes the centroid locations of cells under study to be shifted. While the original reason for this reduction in precision are unknown, we believe that it may have been related to computational limitations at the time of development. At this time, there appears to be no reason to intentionally reduce numerical precision and we believe that full-precision location data should be used in the TVStudy software.

Establishment of Calculation (cell) Grid. The present OET-69 software is designed to establish calculation grids that are for the most part unique to each station considered. This approach requires that all desired and undesired signal levels be calculated for each cell of each station studied and results in cell-level data that cannot be directly compared between different potential channel allotments and/or stations. Another approach is to establish a single, global calculation grid, common to all stations. Such a global approach results in data that can be used to directly compare interference impacts at the cell level, and also speeds calculations since the study grid only needs to be established one time. The TVStudy software is designed to generate and use a global calculation grid.

Treatment of Internal (Longley-Rice) Warnings. The propagation algorithm underlying OET-69 is the Irregular Terrain Model (ITM), also known as Longley-Rice (or simply L-R). It is based in part on actual measurements of path loss made by the Department of Commerce over different terrain profiles. Although the measurement data collected were used to create generalized computational models of different types of terrain profiles, not every single terrain profile possible was represented. In particular, terrain profiles lying outside the range of collected data still produce results, but those results are "flagged" as being "unusable or dubious."

The software used to develop the original DTV Table of Allotments treated cells having such "flags" (whether from desired or interfering stations) as having coverage. This determination results in areas where we have no real information about predicted coverage or

interference. Such cells are assumed to have coverage, even if neighboring cells do not. This treatment of "flagged" results implemented the Commission's decision that assumption of service is appropriate where the Longley-Rice propagation model indicates that service calculations may be dubious or unreliable. Comparisons with other propagation models suggest that the "flagged" results are typically not unreasonable.

We note that while this approach was taken for purposes of implementing OET-69, a different approach was taken in implementing OET Bulletins 72 and 73 (OET-72 and OET-73, respectively) dealing with the availability of TV service for purposes of the Satellite Home Viewer Act and subsequent legislation. In those cases, the L-R propagation model is used differently and for different purposes. Specifically, OET-72 and OET-73 use the L-R model to estimate whether a TV station's signal is receivable at an individual location (a viewer's home), whereas OET-69 estimates a station's signal coverage, population served and interference received over the entire geographic area it serves. With regard to OET-72 and OET-73, the Commission found that ignoring the appearance of so-called "error codes" and accepting the calculated field strength value was appropriate for determining eligibility for satellite delivery of network programming at individual locations.

We ask whether we should to continue to assume coverage in areas that have flagged results in implementing the Commission's decision that assumption of service is appropriate where the Longley-Rice propagation model indicates that service calculations may be dubious or unreliable. If not, we ask what assumptions should be made relative to coverage and population served under such conditions to more effectively implement the Commission's decision.

Availability of Developmental Software and Data

The Commission is making available its developmental TVStudy software and the data required to run it on its website at:

http://data.fcc.gov/download/incentive-auctions/OET-69/

Installation and operating instructions are included as separate files.

The software was developed on an Apple iMac, but it is expected that the source code can be compiled on other Unix-like platforms (*e.g.* Linux). Compatibility of the C source-code with Microsoft Windows-based compilers is not guaranteed, but only minor modification would be expected. The Java code, which was developed in Java version 1.6, is expected to be platform independent. In addition to the source code, a fully-compiled version of the software is supplied for use on Apple computers running OS10.6 or higher. The software also requires certain MySQL client libraries, which can be obtained by installing MySQL Community Server (available at no cost from Oracle). To ensure compatibility, MySQL Community Server version 5.529 is recommended.

Parties seeking to evaluate the TVStudy software will also need various data files for terrain and population. Some of the necessary data files are quite large and so have been archived using TAR and GZip (collectively TGZ) and encoded using PAR2 to facilitate error detection and correction. The necessary data files for population and terrain are supplied at the URL given above, together with a reference copy of CDBS for television stations as of February 22, 2012.

FEDERAL COMMUNICATIONS COMMISSION

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