PUBLIC NOTICE

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INCENTIVE AUCTION TASK FORCE RELEASES SOFTWARE TO GENERATE PAIRWISE CONSTRAINT DATA AND PERFORM FEASIBILITY CHECKING

GN Docket No. 12-268
ET Docket No. 13-26

By this Public Notice, the Incentive Auction Task Force (IATF) is making available additional software regarding technical aspects of the repacking process in the upcoming broadcast television incentive auction:[1]

1. The staff-developed "Constraint Generator" software used to generate pairwise interference constraint files;[2] and

2. An open-source, satisfiability solver-based implementation of "Feasibility Checker" software that can be used to evaluate the feasibility of assigning channels to stations during the repacking process, consistent with the pairwise interference constraint files.[3]

The release of this software continues to fulfill the Commission's commitment to transparency in this proceeding.[4]

In the *Incentive Auction R&O*, the Commission adopted an approach to evaluating the feasibility of assigning television channels to stations that can be used in the context of a real-time descending clock reverse auction.[5] This approach determines whether there exists at least one feasible channel assignment for a given set

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[1] *See Incentive Auction Task Force Releases Information Related to Incentive Auction Repacking*, GN Docket No. 12-268, ET Docket No. 13-26, Public Notice, 28 FCC Rcd 10370 (WTB 2013) (*Repacking Data PN*); *Incentive Auction Task Force Releases Information Related to Repacking; Announces Workshop/Webinar to Provide Additional Detail*, GN Docket No. 12-268, ET Docket No. 13-26, Public Notice, 29 FCC Rcd 47 (WTB 2014) (*Feasibility Checking PN*); *Incentive Auction Task Force Releases Updated Constraint File Data Using Actual Channels and Staff Analysis Regarding Pairwise Approach to Preserving Population Served*, GN Docket No. 12-268, ET Docket No. 13-26, Public Notice, 29 FCC Rcd 5687 (WTB 2014) (*Aggregate Interference PN*).

[2] *See Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions,* GN Docket No. 12-268, Report & Order, 29 FCC Rcd 6567, 6619-20, paras. 114-15 (2014) (*Incentive Auction R&O*).

[3] *See id.* at 6621, para. 117.

[4] *See Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions,* GN Docket No. 12-268, Second Report & Order and Further Notice of Proposed Rulemaking, FCC 14-157, para. 13 n.49 (2014) (*ISIX R&O*).

[5] *See Incentive Auction R&O*, 29 FCC Rcd at 6756, para. 457 ("We adopt the sequential approach [using a feasibility checker] because it comports well with the descending clock auction format. The descending clock auction format, because

(continued….)

of stations using pairwise interference constraint files as first proposed in the *Repacking Data PN*.[6] While the Constraint Generator and Feasibility Checker are distinct pieces of software, they are interrelated: evaluating feasibility requires solving a complex mathematical problem consistent with pairwise interference limits. Building upon data output from *TVStudy* software implementing the methodology described in OET Bulletin No. 69, the Constraint Generator creates pairwise interference constraint files that pre-calculate all the channels a station could be assigned, consistent with the Commission's implementation of the statutory requirement to preserve coverage area and population served.[7] The Feasibility Checker can then be used to determine, within seconds, whether a given channel reassignment is feasible using the pairwise interference constraint files.[8] Together, these software programs are designed to simulate the repacking approach adopted by the Commission in the *Incentive Auction R&O*.[9]

We emphasize that the software we are releasing today is the product of ongoing staff work implementing decisions adopted by the Commission and has not been finalized for use in the incentive auction. The full Commission will make all final decisions regarding the repacking process and other matters relating to the incentive auction at a later date.[10] Our goal in releasing this software is to allow interested parties to validate data previously released by the staff and to simulate their own repacking scenarios. We also emphasize that potential reverse or forward auction participants need not know or master the technical details of the repacking process or the software released today: on the contrary, the Commission has committed to making the reverse auction as transparent and easy to participate in as possible for broadcasters.[11]

In January 2014, the staff released the *Feasibility Checking PN*, which explained how the pairwise interference constraint files could be used "to determine whether, if a given set of reverse auction bids from broadcasters were to be accepted, channels could be assigned to all broadcasters remaining on the air in a manner

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it has multiple rounds, requires that bid assignment procedures be run in every round, and run quickly, so as not to unduly prolong the auction.")

[6] *Repacking Data PN*, 28 FCC at 10371 (explaining that constraint files illustrate "how one could pre-calculate which stations could be assigned to which channels in the repacking process, and which stations cannot operate on the same channels or adjacent channels because of their geographic locations . . . ."). *See Incentive Auction R&O*, 29 FCC Rcd at paras. 114-15 (adopting the approach to developing constraint files first proposed in the *Repacking Data PN* and updated in the *Aggregate Interference PN*, 29 FCC Rcd at 5688-89). The updated constraint files are available on the FCC's LEARN website under the Repacking Section at: http://fcc.gov/learn. These files are also accessible at: http://data.fcc.gov/download/incentive-auctions/Constraint_Files/. These constraint files are not final: the staff will release "a detailed summary of baseline coverage area and population served by each television station to be protected in the repacking process" prior to commencement of the broadcast television spectrum incentive auction. *See Incentive Auction R&O*, 29 FCC Rcd at 6635, para. 145.

[7] See Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, § 6403(b)(2) (codified at 47 U.S.C. § 1452), 126 Stat. 156 (2012) (Spectrum Act); *Incentive Auction R&O* at 6618-20, paras. 113-15; *id.* at 6650, para. 179 (adopting an approach that "preserve[s] service to the same specific viewers for each eligible station, and [allows] no individual channel reassignment, considered alone, [to] reduce another station's population served on February 22, 2012 by more than 0.5 percent.").

[8] As the Commission explained, to ensure that active bidders may drop out of bidding and be assigned a channel in their pre-auction band, "the feasibility of assigning a channel in the pre-auction band must be checked for each non-participating station and each active bidder before each auction round." *Incentive Auction R&O*, 29 FCC Rcd at 6618, para. 110.

[9] *See id.* at 6618-21, paras. 113-18.

[10] *See id.* at 6574, paras. 15-16.

[11] *See id.* at 6570, para. 2.

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consistent with the applicable constraints."[12] We detailed how "feasibility checking" software could perform these checks, specifically discussing two classes of mathematical solvers, but did not release software at that time. In a subsequent workshop, we discussed preliminary performance results in using open-source satisfiability solvers with simulated repacking problems.[13]

While the information that that has been provided publicly was sufficient to allow interested parties to conduct their own repacking simulations,[14] commenters have requested that the staff also release simulation software.[15] With today's releases, interested parties can use the Constraint Generator, in conjunction with previously-released *TVStudy* software, to generate their own pairwise interference constraint files for simulation or validation purposes.[16] Using the Feasibility Checker, released as open-source software by an outside software development team, interested parties can then use the constraint files outputted from the Constraint Generator to perform feasibility checks in a manner similar to the approach the Commission adopted to evaluate feasibility during the real-time reverse auction.[17]

The Incentive Auction Task Force invites interested parties to utilize the software we have made available in this Public Notice to study or conduct their own repacking simulations. All current and subsequent releases relating to the Incentive Auction will be posted to and available on the LEARN website at: http://www.fcc.gov/learn.

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This Public Notice is being issued pursuant to sections 0.31, 0.51, 0.61, and 0.131 of the Commission's rules by the Office of Engineering and Technology and the International, Media, and Wireless Telecommunications Bureaus, members of the Incentive Auction Task Force.[18] Comments may be filed using the procedures for *ex parte* submissions in permit-but-disclose proceedings set forth in section 1.1206 of the Commission's rules.[19] When filing comments, please reference GN Docket No. 12-268 and ET Docket No. 13-26.

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[12] *Feasibility Checking PN*, 29 FCC Rcd at 48.

[13] LEARN Workshop on Feasibility Checking During Repacking Process, FCC (Feb. 21, 2014), *available at* http://www.fcc.gov/events/learn-workshop-feasibility-checking-during-repacking-process.

[14] Letter from Brian J. Benison, Director, Federal Regulatory, AT&T, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 12-268 (filed June 17, 2014); Letter from Trey Hanbury, Counsel for T-Mobile, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 12-268 (filed September 9, 2014).

[15] *See* Letter from Patrick McFadden, Vice President, Strategic Planning, NAB, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 12-268, Attachment at 2 (filed October 9, 2014); Letter from Preston Padden, Executive Director, Expanding Opportunities for Broadcasters Coalition, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 12-268 (filed June 30, 2014); *see also* Comment of the National Association of Broadcasters at 9 (filed July 2, 2014); Reply Comments of Cohen, Dippell, and Everist, P.C. (filed July 22, 2014);

[16] Software packages for multiple platforms, including Microsoft Windows, Mac OS X, and Linux, are available on the FCC's LEARN website under the Repacking Section at: http://fcc.gov/learn.

[17] The source code for the Feasibility Checker is being released and maintained by the outside software development team. In order to expand access, we have mirrored the code on the FCC's own repository, along with that of the Constraint Generator, available at: http://github.com/fcc.

[18] 47 C.F.R. §§ 0.31, 0.51, 0.61, 0.131.

[19] *See* 47 C.F.R. § 1.1206(b)(2).

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