

Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554

In the matter of	)	
	)	
Office of Engineering and Technology Seeks to	)	ET Docket No. 14–14
Supplement the Incentive Auction Proceeding	)	
Record regarding Potential Interference Between	)	
Broadcast Television and Wireless Services	)	
	)	
Expanding the Economic and Innovation	)	GN Docket No. 12–268
Opportunities of Spectrum Through Incentive	)	
Auctions	)	
To: Chief, Office of Engineering and Technology		

**COMMENTS OF ERICSSON**

Ericsson hereby submits its Comments in response to the Public Notice<sup>1</sup> seeking to supplement the record regarding the potential for inter-service interference between digital television (“DTV”) and wireless services.

In response to the *NPRM* and *600 MHz Band Plan Notice* in the Incentive Auction proceeding,<sup>2</sup> several commenters raised concerns about co-channel and adjacent-channel interference between DTV and wireless services arising as a result of market variation. Some commenters proposed the use of a fixed mileage separation distance between the two services, ranging from 100 to 500 km.<sup>3</sup> The Public Notice observes that such proposals were supported

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<sup>1</sup> *Office of Engineering and Technology Seeks to Supplement the Incentive Auction Proceeding Record regarding Potential Interference between Broadcast Television and Wireless Services*, Public Notice, 29 FCC Rcd 712 (OET 2014) (“Public Notice”).

<sup>2</sup> *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Notice of Proposed Rulemaking, 27 FCC Rcd 12357 (2012) (“*NPRM*”); *Wireless Telecommunications Bureau Seeks to Supplement the Record on the 600 MHz Band Plan*, Public Notice, 28 FCC Rcd 7414 (2013) (“*600 MHz Band Supplemental Public Notice*”).

<sup>3</sup> See Public Notice, 29 FCC Rcd at 712-13 nn. 3-4.

by “limited technical analysis.”<sup>4</sup> Accordingly, the Office of Engineering and Technology (“OET”) issued the Public Notice to describe and seek comment on an “alternative methodology” for evaluating the potential for interference between broadcast television and wireless services with the objective of “accommodat[ing] market variation in a more spectrally efficient manner than that proposed by various commenters.”<sup>5</sup>

**General Methodology.** Consideration of an appropriate methodology for predicting potential inter-service interference is an important step. As the Public Notice observes, there are four potential interference cases: (1) DTV to wireless uplink receivers at the base stations; (2) DTV to wireless downlink receivers in the user equipment; (3) Wireless downlink to DTV receivers; and (4) Wireless uplink from user equipment to DTV receiver.<sup>6</sup> A realistic evaluation of the potential for interference in each of these cases is essential for the Commission to establish a bandplan that minimizes interference introduced from market variation.

Ericsson generally accepts that the proposed methodology in the Public Notice can provide reasonable guidance on minimum separation distances between DTV operation and mobile broadband frequencies. Ericsson submits that the four interference scenarios identified above must be analyzed in relation to both co-channel and adjacent channel use of spectrum at an appropriate level of geographical separation. In addition, OET must use the same methodology to analyze the efficacy of guard bands.

Ericsson agrees with OET that case (1), addressing the DTV interference into the wireless base station uplink, necessitates the widest geographical separation requirement. However, we

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<sup>4</sup> *Id.* at 713.

<sup>5</sup> 29 FCC Rcd at 715.

<sup>6</sup> *Id.* at 714.

also reiterate that in our previous set of comments on a suggested band plan<sup>7</sup> and market variability<sup>8</sup>, as well as several submissions from wireless industry commenters that proposed a down from Channel 51 approach where the first uplink allocation is closest to 698 MHz.<sup>9</sup> The need for a basic paired allocation implies that the nearest TV channel will likely interfere with the downlink block rather than the uplink as modelled in the OET case (1). Ericsson's stated position requires at least 2x25 MHz of spectrum to be cleared identically nationwide, with adequate guard bands below the allocation, and a sufficiently large duplex gap, all of which are free from DTV operation. Therefore, in the top ten markets, it is unnecessary to consider case (1) as a relevant interference scenario. While there is a possibility that a second uplink block below channel 37 may be impacted by interference from DTV stations in geographically adjacent areas to deployment, such markets will likely suffer a larger separation distance without significant effect to service viability. While such deployments might benefit from interference mitigation, the efficacy of possible interference mitigation techniques will need detailed study to understand the potential benefits. The inevitable costs in implementing any interference mitigation techniques will no doubt have to be assessed by the wireless industry in relation to the additional population covered.

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<sup>7</sup> See Ericsson Comments on Band Plan PN, GN Docket No. 12-268, at 1-12 (filed June 14, 2013); see also Ericsson Reply Comments at 5-30 (filed March 12, 2013).

<sup>8</sup> See Ericsson Comments on Band Plan PN at 8-9; Ericsson Reply Comments at 12-14.

<sup>9</sup> See, e.g., *Ex parte* letter filed by AT&T, Intel, NAB, Qualcomm, T-Mobile and Verizon Wireless (filed Jan. 24, 2013); Alcatel-Lucent Comments (filed Jan. 25, 2013); AT&T Comments (filed Jan. 25, 2013); Intel Reply Comments (filed March 12, 2013); Qualcomm Comments (filed Jan. 25, 2013); Verizon Comments (filed Jan. 25, 2013); Alcatel-Lucent Comments on Band Plan PN (filed June 14, 2013); AT&T Comments on Band Plan PN (filed June 14, 2013); Qualcomm Comments on Band Plan PN (filed June 14, 2013); Verizon Comments on Band Plan PN (filed June 14, 2013).

With respect to case (3), involving wireless base station interference into DTV receivers, Ericsson suggests that OET's estimate of low impact<sup>10</sup> may need reexamination. Ericsson's preliminary calculations indicate that the separation distances for that scenario, while not as high as for case (1) as discussed above, are still significant enough to warrant some impact to wireless broadband services close to edge of the coverage contour of the television station. Ericsson believes that this case will affect limits on deployment and may impact the market variability analysis more than case (1). The other interference cases, (2) and (4), pose significantly lower risk to use of the 600 MHz band for wireless mobile broadband services and may generally be ignored in deference to cases (3) and (1) respectively.

Consideration of these issues will advance a better understanding of the incentive auction plan and the valuation of spectrum by the industry and the Commission.

***Propagation Models.*** As the Public Notice points out, the Commission has often used the "Longley-Rice" radio propagation model,<sup>11</sup> also known as the "Irregular Terrain Model" or "ITM,"<sup>12</sup> for assessing television coverage and interference over large distances.<sup>13</sup> However, the Commission has not previously employed ITM "in a wireless or inter-service context," and the

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<sup>10</sup> See Public Notice, 29 FCC Rcd at 715 ("Although the separation distance may be relatively large between a wireless base station and a co-channel DTV transmitter operating in the base station's uplink spectrum (Case 1), the distance from a wireless base station to DTV receivers at the edge of a DTV station's service contour would be much less.").

<sup>11</sup> A.D. Longley and P. L. Rice, *Prediction of Tropospheric Radio Transmission Loss over Irregular Terrain – A Computer Method – 1968*, ESSA Tech. Report ERL 79-ITS 67 (1968), <http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=AD0676874>.

<sup>12</sup> G.A. Hufford, A.G. Longley, W.A. Kissick, *A Guide to the Use of the ITS Irregular Terrain Model in the Area Prediction Mode*, NTIA Report 82-100 (April 1982), [http://www.ntia.doc.gov/files/ntia/publications/ntia\\_82-100\\_20121129145031\\_555510.pdf](http://www.ntia.doc.gov/files/ntia/publications/ntia_82-100_20121129145031_555510.pdf).

<sup>13</sup> 29 FCC Rcd at 717 & n.11.

Public Notice seeks comment on the degree to which it is an appropriate model for the four interference scenarios at issue, as well as suggestions for alternatives.<sup>14</sup>

Ericsson notes that while terrestrial long-range links have successfully been modeled using ITM, that model has not typically been used in predicting wireless coverage in cellular networks, where the distances are much shorter than those in television broadcasting. The “extended Hata model,” which is designed for distances typical of cellular transmissions,<sup>15</sup> is typically used for cellular propagation estimates, including in 3GPP working groups.<sup>16</sup>

The extended Hata model has generally been validated for cellular environments when properly tuned for the urban, suburban or rural case. Indeed, coexistence analyses conducted in the 3GPP standards meetings have developed models for transmit power distributions of user equipment that are very much in line with measured values in the field and that validate predictions made by the extended Hata model. It would be difficult to tune uplink power control to match field measurements if the ITM model were adopted for the cellular link. Indeed, this approach was recognized by the CSMAC Working Group 1 when analyzing the performance of

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<sup>14</sup> 29 FCC Rcd at 717. The Public Notice specifically acknowledges that Longley-Rice may not be suitable for the fourth interference case, wireless uplink from user equipment to TV receiver, because of the short distances involved. *Id* at n.12.

<sup>15</sup> *See, e.g.*, Recommendation ITU–R P.529–3, *Prediction Methods for the Terrestrial Land Mobile Service in the VHF and UHF Bands* at 6-7 (1999), [http://www.itu.int/dms\\_pubrec/itu-r/rec/p/R-REC-P.529-3-199910-W!!PDF-E.pdf](http://www.itu.int/dms_pubrec/itu-r/rec/p/R-REC-P.529-3-199910-W!!PDF-E.pdf) (providing Okamura-Hata equations for distances to 20 km and extended to 100 km); Imranullah Khan, Tan Chon Eng, Shakeel Ahmed Kamboh, *Performance Analysis of Various Path Loss Models for Wireless Network in Different Environments*, 2 *Int. J. Eng. And Adv. Tech.* 161 (Oct. 2012), <http://www.ijeat.org/attachments/File/v2i1/A0757102112.pdf>; National Institute of Standards and Technology, *Description of HATA, CCIR, and Walfisch-Ikegami Models*, [http://w3.antd.nist.gov/wctg/manet/calcmmodels\\_r1.pdf](http://w3.antd.nist.gov/wctg/manet/calcmmodels_r1.pdf) at 5.

<sup>16</sup> *See, e.g.*, Recommendation ITU–R P.529–3; 3GPP TR 25.996 V10.0.0 (2011-03): Technical Report 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Spatial channel model for Multiple Input Multiple Output (MIMO) simulations (Release 10) at 17, [http://www.3gpp.org/ftp/specs/archive/25\\_series/25.996/25996-a00.zip](http://www.3gpp.org/ftp/specs/archive/25_series/25.996/25996-a00.zip).

LTE in the vicinity of earth stations in the meteorological bands used by the GOES and POES downlink channels. The chosen compromise was to analyze the performance of cellular links using the extended Hata propagation model.<sup>17</sup>

On the other hand, the ITM model has the advantage of validity over long distances and can handle the effect of curvature of the earth. One way around this discrepancy is to use the ITM model for long range terrestrial links and to use the extended Hata model for the cellular domain.

Ericsson urges the Commission to carefully consider the implications and difficulties of either of two approaches: (1) using the ITM model alone; or (2) using the ITM model for DTV in combination with the extended Hata model for cellular links favorable for modeling area coverage and clutter over short distances. It is also important in the methodology to account for each market's population density when simulating interference performance. To the extent the extended Hata model is adopted for cellular links, the Commission should consider incorporating it directly into the TVStudy software package. In addition Ericsson suggests that the Commission also consider the use of a finer resolution to identify where within an EA interference from DTV is likely to occur, given that the DTV interference contour is not uniformly distributed across an impacted EA.

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<sup>17</sup> See Commerce Spectrum Management Advisory Committee, *Final Report, Working Group 1 – 1695-1710 MHz Meteorological-Satellite, Rev. 1* (July 23, 2013), [http://www.ntia.doc.gov/files/ntia/publications/wg1\\_report\\_07232013.pdf](http://www.ntia.doc.gov/files/ntia/publications/wg1_report_07232013.pdf)

Respectfully submitted,

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