

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

In the Matter of)	
)	
Establishment of a Model for Predicting)	ET Docket No. 10-152
Digital Broadcast Television Field Strength)	
Received at Individual Locations)	
)	

COMMENTS OF DISH NETWORK L.L.C.

DISH Network L.L.C. (“DISH”) files these comments in response to the *Further Notice* in the above-captioned proceeding concerning improvements to the Commission’s model for predicting digital broadcast television field strength at individual locations more accurately and reliably.¹ The *Further Notice* specifically seeks comment on a proposal for modifying the Individual Location Longley-Rice (“ILLR”) model by replacing the Irregular Terrain Model (“ITM”) component with a Irregular Terrain With Obstructions Model (“ITWOM”).² This proposal has been made in comments filed in this proceeding by Sidney Shumate, president of the Givens & Bell engineering firm.³ DISH expresses qualified support for ITWOM as a potentially useful but insufficient improvement to the model, discusses the potential implications of Mr. Shumate’s findings for the ILLR model, and submits the attached engineering analysis conducted by Christopher Kurby in support of its comments.⁴

¹ Establishment of a Model for Predicting Digital Broadcast Television Field Strength Received at Individual Locations, ET Docket No. 10-152, *Report and Order and Further*, FCC 10-194, (rel. Nov. 23, 2010) (“*Report and Order*” or “*Further Notice*” as appropriate).

² *Id.* ¶¶ 57-58.

³ See Sidney Shumate, Petition for Rulemaking and Comment, ET Docket Nos. 00-11, 10-152 (filed Aug. 24, 2010) (“ITWOM Proposal”).

⁴ Engineering Analysis and Statement of Christopher Kurby, ET Docket Nos. 10-152 (filed Jan, 21, 2011) (attached hereto) (“Kurby Report”).

The ITWOM Proposal seems to be a partial solution to a problem the severity of which Mr. Shumate's comments shed useful light. The field tests cited by Mr. Shumate in comparing the standard ILLR model and his ITWOM variant show that use of the former produces an average overprediction of 6.61 dBu over actual measured strength. As Mr. Kurby explains, the implications of this are startling. The field results suggest that as many as 51% of households that are actually unserved are falsely predicted to be served under the model and are therefore perhaps unfairly disqualified from receiving distant network stations. While the ITWOM variant reduces the overprediction to 1.93 dBu, it would not eliminate the upward bias, which of course results in unfair disenfranchisement of consumers wishing to receive distant network stations.

The Commission should adopt the ITWOM Proposal subject to certain pre-conditions and modifications. First, the Commission should confirm the test results cited by Givens & Bell in the ITWOM Proposal through recourse to more extensive and rigorous field studies. Second, the Commission should subtract from the ILLR-predicted values the average number of dBu by which the ITWOM predicted strength still exceeds actual strength.

Moreover, the test results cited in the ITWOM Proposal cast grave doubt on the accuracy of the field tests conducted in 2000 on behalf of the broadcast interests⁵ – tests on which the Commission had relied to set the current land use/clutter values.⁶ The Commission set these values at zero for VHF signals based on the belief that the model “already” produces more underpredictions than overpredictions, and that further downward adjustments would exacerbate that downward bias. But the test results cited by Mr. Shumate suggest the opposite – that the model produces a pronounced upward bias. If so, recognizing that land use/clutter losses are real would *reduce* the inconsistency, not increase it, and there would be no reason for the

⁵ ITWOM Proposal at 9.

⁶ *Report and Order* ¶ 46.

Commission to set these values artificially at zero. The Commission should urgently reassess the accuracy of these earlier studies and recognize land use/clutter losses even if it does not adopt the ITWOM Proposal.

I. IMPROVEMENTS TO THE STANDARD ILLR MODEL ARE NECESSARY

The Commission asks for additional information concerning the methodological changes proposed to the ILLR model to better take account of signal loss due to obstructions.⁷

Improvement in this area is necessary – the land use/clutter adjustment of zero for all VHF signals is not a satisfactory reflection of the impact of such obstacles on signal propagation. While maintaining that the zero variable still “strikes the correct balance,” the Commission “understand[s] the seeming inconsistency of using no LULC corrections for VHF signals.”⁸ But the inconsistency is more than seeming; as shown below, it may be explained by a simple fact: the broadcasters’ study, on which the Commission exclusively relied, may have been simply wrong in concluding that an adjustment greater than zero would exacerbate the model’s supposed downward bias. But in any event, it is also true that the ILLR model’s method for predicting line of sight diffraction loss is itself amenable to improvement. As a threshold matter, therefore, DISH is very interested in any action that would improve the accuracy of the prediction. But while it appears to hold promise, the ITWOM variant (a) requires further study; and (b) does not go far enough.

II. THE ITWOM PROPOSAL, IF ITS RESULTS ARE CORROBORATED, IS A NECESSARY BUT INSUFFICIENT STEP IN THE RIGHT DIRECTION

DISH has started analyzing the ITWOM Proposal. Mr. Shumate claims that the ILLR model is not a true point-to-point model, as it averages the signal loss at three different points on

⁷ *Further Notice* ¶ 58.

⁸ *Report and Order* ¶ 46.

the radial.⁹ The ITWOM Proposal would replace this method and estimate the losses close to an obstruction in a way truly specific to the point in question (*i.e.*, presumably, to the particular household whose served or unserved status is being estimated).¹⁰

Mr. Shumate also cites test results that compare the results of each predictive method (the standard ILLR model and the ITWOM model) with actual readings of signal strength. These results are sobering, if for no other reason than they uncover a large discrepancy between standard ILLR predictions and actual measurements. According to the ITWOM Proposal, the average error of the standard ILLR predictions was “only” 6.61 dBu.¹¹ As Mr. Kurby estimates, this means that as many as 51% of unserved households are not predicted as unserved by the model.¹² Setting aside the question of whether such a sizable discrepancy is properly discounted by “only,” the ITWOM Proposal goes on to show that the ILLR model is exacerbated by another problem: “the radial averaging system used in the ITM produced a wide variance in the error values.”¹³

The ITWOM method, for its part, resulted assertedly in predictions that exceeded the actual numbers by a much smaller average number, 1.93 dBu.¹⁴ According to Mr. Kurby, this lower discrepancy reduces the erroneous prediction of unserved households as served from 51% to a still disconcerting 19% of the unserved households.¹⁵

⁹ ITWOM Proposal at 3-4.

¹⁰ *Id.* at 6-9.

¹¹ *Id.* at 7.

¹² Kurby Report at 1.

¹³ ITWOM Proposal at 7.

¹⁴ *Id.*

¹⁵ Kurby Report at 1.

This appears to be a step in the right direction. Nevertheless, it should, first, be confirmed by additional field studies. The information provided by Mr. Shumate to date, for example, does not include the distribution curve for the 1,069 households measured and does not permit calculation of the median (vs. average) exceedance of predicted values over actual readings under ITWOM.

Second, such steps are necessary but not enough: there is no reason for the predictions to feature *any* persistent upward bias, including one of 1.93 dBu. As mentioned, any such bias means that, on average, the predictive method conjures up a higher strength than the signal's actual strength. Thus, more households that are actually unserved are predicted as served than the other way around (*i.e.*, than households actually served that are predicted as unserved). This is a serious systemic error. A simple way to correct it is this: if the test results cited by the ITWOM Proposal are borne out by the more extensive study suggested above, the average exceedance of 1.93 dBu should be subtracted from the predicted value until a more precise predictive model becomes available.

III. THE COMMISSION SHOULD REVISIT THE LAND USE/CLUTTER VALUES IN LIGHT OF THE ITWOM PROPOSAL

The test results cited in the ITWOM Proposal have yet another significant implication. They invite serious questions about the accuracy of another set of field studies aggregated and analyzed by Jules Cohen and presented to the Commission in 2000.¹⁶ The Commission had relied on these earlier studies to decide that no land use/clutter adjustment was appropriate for

¹⁶ Jules Cohen, Engineering Statement in Support of National Association of Broadcasters Comments, ET Docket No. 00-11 (filed Feb. 23, 2000).

VHF.¹⁷ The fact that there are positive land use/clutter losses for these signals is undeniable and has not been denied by the Commission. Rather, the Commission explained that the model already produces more underpredictions than overpredictions, and that, therefore, recognizing these losses would exacerbate that downward bias and make the model less accurate still.¹⁸ But average exceedance of 6.61 dBu over measured strength suggests the opposite – a strong *upward* bias. Mr. Shumate’s results thus suggest strongly that the previous results are incorrect (barring a very unusual distribution where very few households accounted for a disproportionate amount of the overprediction). If so, recognition of land use/clutter losses would *reduce* the inaccuracy of the model, not increase it. The Commission should investigate this inconsistency and consider incorporating positive values for VHF signals (even if it does not adopt ITWOM) to reflect the fact that these signals do not travel in a void.¹⁹

IV. CONCLUSION

The ITWOM Proposal demonstrates that there is still much room for creating a more reliable and accurate predictive model. The Commission has the statutory responsibility to refine and improve its predictive model. It should consider the ITWOM Proposal as a necessary but insufficient starting point to that end. It should moreover request more information about the tests discussed in the ITWOM Proposal, and reopen the question of the appropriate land use/clutter adjustment.

¹⁷ Establishment of an Improved Model for Predicting the Broadcast Television Field Strength Received at Individual Locations, *First Report and Order*, 15 FCC Rcd. 12118, 12124-27 (2000).

¹⁸ *Id.*

¹⁹ *See* Kurby Report at 2.

Respectfully submitted,

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Irregular Terrain With Obstructions Model (“ITWOM”) An Engineering Analysis

Introduction:

This report sets forth a preliminary evaluation of the “ITWOM” variant of the Individual Locations Longley-Rice (“ILLR”) model developed by the Givens & Bell engineering firm and previously submitted to the FCC.

Propagation model and ITWOM computer tool

In response to the *Notice of Proposed Rulemaking* in ET Docket No. 10-152, Establishment of a Model for Predicting Digital Broadcast Television Field Strength Received at Individual Locations, S. Shumate [1] of the Givens & Bell engineering firm submitted a document proposing modifications to the present ILLR computer model to enhance the accuracy of predictions. In this same time frame he presented a paper [2] to the IEEE Vehicular Technology Conference of September 2010 providing more detail on the theory underlying the model. In the FCC submission, he reports that the new model, named ITWOM, resulted in a +1.93dBu average exceedance of predicted DTV signal level compared to the measured data on 1069 readings. He also reported that the ILLR FCC model, named ITM, had +6.61dB error (also average exceedance of predicted strength over actual strength) for the same data.

The ITWOM model was also shown by Shumate to have a lower standard deviation from the ILLR model in a scenario they identified as extremely difficult. From the figures 1a and 1b, it visually appears that the average error of the models are both between +10 and +20dB, though Shumate provides no value for this. This lower variance observed under the ITWOM variant would, if confirmed, lead to more accurate estimates overall although it would be insufficient, standing alone, to cure all of the ILLR model’s defects.

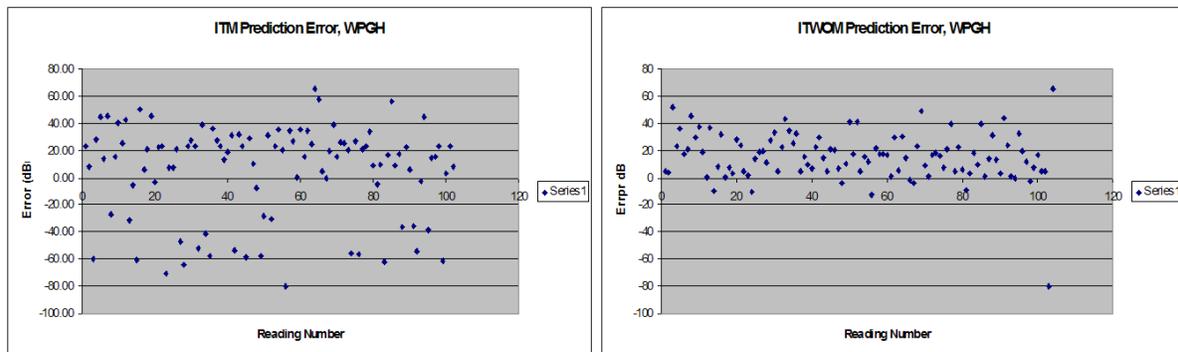


Figure 1a and Figure 1b Difficult TV conditions with the LTM (ILLR) and ITWOM models

Of particular concern is that an over prediction of signal level will eliminate users from being correctly designated as unserved by the local network signal. Using the FCC (50,50) propagation curves for channels 2-6 the tables below are generated to calculate the ratio of area unserved for the corrected range vs. the uncorrected range using the errors of 1.93 and 6.61dBu at an assumed range limit of 50Km for a 600M antenna height.

Table 1 : Comparison of ILLR and ITWOM coverage with error

model	range initial (Km)	delta E(dB/uv)	r2/r1	sqr(r2/r1)
ITWOM	50	1.93	0.90	0.81
ILLR	50	6.61	0.70	0.49

Thus, the present ILLR model bias as presented by Shumate predicts that 51% of the unserved users are served contrasted with the 19% in the ITWOM model as judged by the area covered.

If the 1.93dB error is consistent with the ITWOM model in most scenarios, the strength prediction should be adjusted by the known error factor of 1.93 dB lower until the model is improved to correct this deficiency.

The test results warrant further study. The information provided by Mr. Shumate to date, for example, does not include the distribution curve for the 1,069 households measured and does not permit calculation of the median (vs. average) error and exceedance of predicted values over actual readings under ITWOM.

The field studies discussed by Mr. Shumate also call into question the accuracy of another set of field studies aggregated and analyzed by Jules Cohen and presented to the Commission in 2000. The Commission had relied on these earlier studies to conclude that no land use/clutter adjustment was appropriate for VHF. The fact that there are positive land use/clutter losses for these signals is undeniable. Rather, the Commission explained that the model already produces more underpredictions than overpredictions, and that, therefore, recognizing these losses would exacerbate that downward bias and make the model less accurate still. An average exceedance of 6.61dB over measured strength suggests the opposite – a strong *upward* bias. Mr. Shumate's results thus suggest strongly that the previous results are incorrect (barring a very unusual distribution where very few households accounted for a disproportionate amount of the overprediction). If so, recognition of land use/clutter losses would *reduce* the inaccuracy of the model, not increase it. The Commission should investigate this inconsistency and consider incorporating positive values for VHF signals (even if it does not adopt ITWOM) to reflect the fact that these signals do not travel in a void.

References

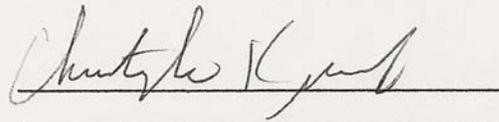
[1] Sidney E. Shumate, Givens & Bell, Inc., Petition for Rulemaking and Comment, ET Docket No. 00-11, ET Docket No. 10-152 (August 24, 2010).

[2] Sidney E. Shumate, Longley-Rice and ITU-P.1546 Combined, Vehicular Technology Conference (VTC Fall 2010).

DECLARATION

I, Christopher Kurby, declare that I have prepared the foregoing engineering analysis using facts of which I have personal knowledge or upon information provided to me. I declare under penalty of perjury that the foregoing is true and correct to the best of my information, knowledge and belief.

Executed on January 21, 2011.

A handwritten signature in cursive script, appearing to read "Christopher Kurby", is written over a solid horizontal line.

Christopher Kurby, MEM, MEE, BSEE