BROOKS, PIERCE, MCLENDON, HUMPHREY & LEONARD, L.L.P.
ATTORNEYS AT LAW
RALEIGH, NORTH CAROLINA

DOCKET FILE COPY ORIGINAL

MAILING ADDRESS
POST OFFICE BOX 1800
RALEIGH, N.C. 27602

OFFICE ADDRESS
SUITE 1600
FIRST UNION CAPITOL CENTER
150 FAYETTEVILLE STREET MALL
RALEIGH, N.C. 27601

TELEPHONE 919-839-0300
FACSIMILE 919-839-0304

L.P. McLENDON, JR.
HUBERT HUMPHREY
EDGAR B. FISHER, JR.
W. ERWIN FULLER, JR.
JAMES T. WILLIAMS, JR.
WADE H. HARGROVE
M. DANIEL McGINN
MICHAEL D. MEEKER
WILLIAM G. McNAIRY
EDWARD C. WINSLOW III
HOWARD L. WILLIAMS
GEORGE W. HOUSE
WILLIAM P.H. CARY
REID L. PHILLIPS
ROBERT A. SINGER
JOHN H. SMALL
RANDALL A. UNDERWOOD
S. LEIGH RODENBOUGH IV
WILLIAM G. ROSS, JR.
MARK J. PRAK
JILL R. WILSON
MARC D. BISHOP
JIM W. PHILLIPS, JR.
MACK SPERLING
JEFFREY E. OLEYNIK
MARK DAVIDSON
JAMES R. SAINTSING
JOHN W. ORMAND III
ROBERT J. KING III
STEVEN J. LEVITAS
V. RANDALL TINSLEY
JOHN R. ARCHAMBAULT
S. KYLE WOOSLEY

DANIEL M. SROKA
FORREST W. CAMPBELL, JR.
MARCUS W. TRATHEN
JEAN C. BROOKS
ELLEN P. HAMRICK
JAMES C. ADAMS, II
ALLISON M. GRIMM
ELIZABETH S. BREWINGTON
H. ARTHUR BOLICK II
NATASHA RATH MARCUS
JOHN M. CROSS, JR.
JENNIFER K. VAN ZANT
KEARNS DAVIS
DAVID W. SAR
KATHLEEN M. THORNTON
BRIAN J. McMILLAN
JENNIFER L. BOLICK
DAVID KUSHNER
DEREK J. ALLEN
ELIZABETH V. LAFOLLETTE
GINGER S. SHIELDS
HAROLD H. CHEN
COE W. RAMSEY
NATALIE KAY SANDERS
ROBERT W. SAUNDERS
DAVID SHUB
JENNIFER T. HARROD
CHARLES E. COBLE
JOHN M. DeANGELIS
CLINTON R. PINYAN
KATHRYN V. PURDOM
ANDREW KIRK SUSONG

FOUNDED 1897

AUBREY L. BROOKS (1872-1958)
W.H. HOLDERNESS (1904-1965)
L.P. McLENDON (1890-1968)
KENNETH M. BRIM (1898-1974)
C.T. LEONARD, JR. (1929-1983)
CLAUDE C. PIERCE (1913-1988)
THORNTON H. BROOKS (1912-1988)
G. NEIL DANIELS (1911-1997)

GREENSBORO OFFICE
2000 RENAISSANCE PLAZA
230 NORTH ELM STREET
GREENSBORO, N.C. 27401

WASHINGTON OFFICE
601 PENNSYLVANIA AVENUE, N.W.
SUITE 900, SOUTH BUILDING
WASHINGTON, D.C. 20004

February 22, 2000

RECEIVED
FEB 22 2000
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
445 12th Street, S.W., TW-A306
Washington, D.C. 20554

Re: Joint Comments of ABC, CBS, FOX, and NBC Television Network Affiliate Associations, ET Docket No. 00-11

Dear Ms. Salas:

Transmitted herewith on behalf of the ABC Television Affiliates Association, the CBS Television Network Affiliates Association, the Fox Television Affiliates Association, and the NBC Television Affiliates Association are an original and nine (9) copies of Joint Comments for filing in the above-captioned proceeding.

If any questions should arise during the course of your consideration of this matter, it is respectfully requested that you communicate with this office.

Sincerely,

Wade H. Hargrove

Enclosures

No. of Copies rec'd 0+4
List A B C D E

Before the
Federal Communications Commission
Washington, D.C. 20554

RECEIVED
FEB 22 2000
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of	)	
	)	
Establishment of an Improved Model for	)	ET Docket No. 00-11
Predicting the Broadcast Television Field	)	
Strength Received at Individual Locations	)	

To: The Commission

JOINT COMMENTS OF THE
ABC, CBS, FOX, AND NBC
TELEVISION NETWORK AFFILIATE ASSOCIATIONS

Wade H. Hargrove
David Kushner
BROOKS, PIERCE, McLENDON,
HUMPHREY & LEONARD, L.L.P.
First Union Capitol Center
Suite 1600 (27601)
Post Office Box 1800
Raleigh, North Carolina 27602
Telephone: (919) 839-0300
Facsimile: (919) 839-0304
Counsel for the ABC Television Affiliates Association and for the Fox Television Affiliates Association

Kurt A. Wimmer
COVINGTON & BURLING
1201 Pennsylvania Avenue, N.W. (20004)
Post Office Box 7566
Washington, D.C. 20044-7566
Telephone: (202) 662-6000
Facsimile: (202) 662-6291
Counsel for the CBS Television Network Affiliates Association and for the NBC Television Affiliates Association

February 22, 2000

Table of Contents

Summary iv

I. In Attempting To Improve The ILLR Model, The Commission Must Continue To Be Guided By The Recognition That The Section 119 License Is In Derogation Of Local Broadcast Stations' Exclusive Property Rights 2

II. There Are Numerous Methodological Problems With The *Notice*'s Proposed Clutter Loss Values 8

1. Receiving Antenna Height 9

2. Transmitting Antenna Height 12

3. Polarization And Other Antenna-Type Differences 16

4. Fresnel Zone Clearance 17

5. Extrapolation To Low VHF Frequencies 17

6. Rubinstein's Use Of Okumura's Curves For Signal Strength Predictions 19

7. Limited Number And Types Of Geographical Areas Surveyed 20

III. There Are Serious Difficulties With Attempting To Use The USGS Land Use And Land Clutter Categories For Purposes Of Refining The ILLR Model 23

1. USGS LULC Grid Size 24

2. Age Of USGS LULC Database 25

IV. Longley Has Derived An "Urban Factor" Correction That Confirms That The ILLR Model Is Highly Accurate In Its Current Form 26

V. Error Code Treatment Must Not Result In Underprediction Of Service 34

VI. Certain Parameter Values In The ILLR Model Need To Be Modified 39

Conclusion 40

Engineering Statement Of IIT Research Institute, Center For Electromagnetic Science . . . . . *Appendix*

Prediction Curves For Vehicular Antenna Height Gain In An Urban Area . . . . . *Exhibit 1*

Median Field Strength Versus Distance In Urban Areas, 453 MHz . . . . . *Exhibit 2*

Summary

SHVIA directs the Commission to ensure that the Individual Location Longley Rice ("ILLR") model takes into account terrain, building structures, and other land cover variations such as vegetation. The ILLR model, however, is a semi-empirical model whose empirical foundations, based on data collected from mobile runs, necessarily incorporate whatever vegetation and buildings existed at the time of the mobile runs. Therefore, the ILLR model already takes into account "building structures[] and other land cover variations," and SHVIA's requirement to do so is already fulfilled.

Moreover, in making any modifications to the ILLR model, the Commission must keep two things in mind. First, in light of the statutory language, Conference Report, and SHVIA's legislative history, it is clear that Congress only intended for the Commission to modify the ILLR if, in doing so, the Commission is able to increase the model's accuracy as measured by actual field test data. Second, a compulsory copyright license is in derogation of the exclusive copyrights held by local broadcast stations and, therefore, the terms of the compulsory license must be narrowly construed. Accordingly, the Commission must strive to avoid any underprediction of service, and any doubt or ambiguity as to the model's predictions should be interpreted in favor of service.

The clutter loss values proposed in the Commission's *Notice* do not enhance the accuracy of the ILLR model. The *Notice* proposes that clutter loss values for any particular location be taken from a table providing clutter loss factors based on data published by T.N. Rubinstein with an extrapolation for low VHF frequencies based on trends developed by Y. Okumura. This proposal

suffers from numerous methodological defects, including the following:

- **Receiving Antenna Height.** The height of the receiving antennas used by Rubinstein to collect his data was substantially lower than the assumed height for household television antennas. Because clutter loss is greater at lower heights, Rubinstein's data substantially overstate the amount of clutter loss present for receiving antennas at rooftop level. The overstatement is at least 4 dB for an antenna at 6 meters and 7 dB for an antenna at 9 meters.

- **Transmitting Antenna Height.** Rubinstein's collected clutter loss data rely on transmitting antenna heights significantly lower than those used by television broadcast stations. Because clutter loss is greater at lower transmitting antenna heights, Rubinstein's data overstate the amount of clutter loss for television signals on the order of 15 dB.

- **Polarization and Other Antenna-Type Differences.** Rubinstein used mobile, nondirectional, non-optimized monopole antennas receiving vertically polarized signals whereas a television receiving antenna is typically a fixed, directional dipole or multi-element antenna which is directed towards the transmitting antenna and receives horizontally-polarized signals. As a result, Rubinstein's data overstate clutter loss for television signals on the order of 3-9 dB.

- **Fresnel Zone Clearance.** Rubinstein's receiving antennas were too close to the ground and other obstacles to achieve Fresnel zone clearance. The data are contaminated and overstate the clutter losses by 4-5 dB.

- **Extrapolation for Low VHF Frequencies.** Rubinstein did not collect data for low VHF frequencies. Because there is some doubt as to the accuracy of the extrapolation and because there can be no assurance that the extrapolated clutter loss values do not underpredict Grade B service, the Commission should not incorporate clutter loss values for low VHF.

- **Rubinstein's Use of Okumura's Curves for Signal Strength Prediction.** Rubinstein computed signal strength predictions from an assumed base of urban clutter loss, added an open space correction factor that attempts to eliminate this clutter loss in open spaces, and then subtracted the clutter losses empirically determined. This methodology makes no sense for purposes of modifying the ILLR model.

- **Limited Number and Types of Geographical Areas Surveyed.** Rubinstein surveyed only two distinct types of built-up areas (heavily urbanized and

> rural/suburban) in only three types of geographical areas. These data are far too slim a basis upon which to base clutter loss values throughout the United States and, accordingly, the clutter loss values proposed in the *Notice* are inadequate.

Basing clutter loss values on Rubinstein's data results in inaccurate values that systematically overstate the amount of clutter loss for television signals. In fact, considering the *minimum* effects of the disparities in receiving antenna heights, transmitting antenna heights, polarization, and Fresnel zone clearance reduces to zero all the clutter loss values proposed in the *Notice*.

There are serious deficiencies with the United States Geological Survey's Land Use and Land Clutter database that make its use for purposes of modifying the ILLR model highly questionable. The grid scale used in the LULC database is far too gross to accurately reflect the land cover variations at the receiving antenna site. Moreover, the USGS's LULC database was generated from data obtained more than 20 years ago. Consequently, much of the data for urban regions and their immediate environs is suspect due to development over the past two decades. Accordingly, the Commission should await the data reduction of the Landsat 7 data that is currently being obtained.

Anita Longley previously developed an "urban factor" that was intended to be applied as a correction to the Longley-Rice model in order to account for generalized urban clutter, including buildings and vegetation. Consideration of Longley's "urban factor" confirms that at distances near the traditional FCC-determined Grade B fringe of a television station's service area there is essentially no clutter loss for which the ILLR model does not already account.

The Commission must not adopt a rule conflating the presence of certain error code markers with lack of adequate signal strength. If the ILLR model is run as the *Notice* proposes, approximately one-fifth of the viewers of any given local network affiliate will automatically be

classified as "unserved." This one change could do more harm to the viability of local network affiliates than any other change proposed in the *Notice*. Moreover, treating flagged locations as unserved is inconsistent with the Commission's prior decision on this issue. In last year's SHVA proceeding, the Commission concluded that parties should either ignore error codes or test the predicted result with an actual on-site measurement. The Commission reached this conclusion because it realized that assuming a lack of service when an error code is returned shifts onto broadcast stations the burden of proving (through actual testing) that a household is unserved. Such burden shifting away from satellite carriers and onto broadcast stations contravenes the express language of the statute. The Commission's conclusion in last year's SHVA proceeding still holds and should not be repudiated.

It is recommended that the ILLR model be refined by taking into account appropriate and realistic values for surface refractivity rather than relying on a median surface refractivity value as proposed in the *Notice*.

The ILLR model has been demonstrated to be an accurate predictor of signal strength at individual locations, and, because the model is empirically based, it already incorporates relevant clutter data. It is clear from SHVIA's language and the legislative history that the Commission cannot modify the ILLR model unless those modifications increase the model's accuracy as measured by actual field test data. It continues to be premature to modify the ILLR model based on the engineering and technical studies that have been performed to date.

* * *

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Establishment of an Improved Model for Predicting the Broadcast Television Field Strength Received at Individual Locations	)))	ET Docket No. 00-11

To: The Commission

JOINT COMMENTS OF THE
ABC, CBS, FOX, AND NBC
TELEVISION NETWORK AFFILIATE ASSOCIATIONS

The ABC Television Affiliates Association, the CBS Television Network Affiliates Association, the Fox Television Affiliates Association, and the NBC Television Affiliates Association (collectively, the "Network Affiliates"), by their attorneys, hereby submit these comments in response to the Commission's *Notice of Proposed Rule Making* ("*Notice*"), FCC 00-17, released January 20, 2000, in the above-captioned proceeding. The Network Affiliates represent more than 800 local television broadcast stations throughout the nation that are affiliated with one of the four major television broadcast networks. The *Notice* seeks comment on the manner in which the effects of vegetation and buildings on signal intensity at individual locations should be incorporated into the Individual Location Longley-Rice model.

I. In Attempting To Improve The ILLR Model, The Commission Must Continue To Be Guided By The Recognition That The Section 119 License Is In Derogation Of Local Broadcast Stations' Exclusive Property Rights

Last year, in its *Report and Order* in CS Docket No. 98-201 (hereinafter "*SHVA Order*"), the Commission endorsed the use of a specific propagation model for predicting signal strength at individual locations. This model, which is a version of Longley-Rice 1.2.2 run in individual, i.e., point-to-point, mode, was termed the "Individual Location Longley-Rice" ("ILLR") model.[1] Because of the lack of consensus in the scientific and technical community as to the appropriate means to do so, the effects of vegetation and buildings ("clutter") on signal intensity at individual locations were not incorporated into the recommended model.

In the *SHVA Order*, the Commission recognized several important principles that guided its decision to recommend the ILLR model in the form that it did. First, the Commission respected the fact that the "Satellite Home Viewer Act limits the compulsory copyright license to 'unserved' households, reflecting Congress' intent to protect the role of local broadcasters in providing free, over-the-air television to American families."[2] Second, the Commission sought to formulate an approach throughout the *SHVA Order* whose effect would neither "increase the number of unserved households that already exist, nor . . . reduce the size of local stations' markets by subtracting

---

[1] *See* Satellite Delivery of Network Signals to Unserved Households for Purposes of the Satellite Home Viewer Act, *Report and Order*, FCC 99-14, 14 FCC Rcd 2654 (1999) ("*SHVA Order*").

[2] *Id.* at ¶ 11.

viewers who are able to receive their signal."[3] Third, the Commission properly observed that "when served households are deemed eligible for satellite-delivered broadcast network service, network affiliates are harmed and the SHVA's intent is also thwarted."[4] Finally, the Commission recognized that a "predictive model that includes truly served households in an unserved category, even temporarily, creates . . . undesired effects."[5] These principles must continue to guide the Commission in the instant proceeding.

SHVIA states, in pertinent part:

> Within 180 days after the date of the enactment of the Satellite Home Viewer Improvement Act of 1999, the Commission shall take all actions necessary, including any reconsideration, to develop and prescribe by rule a point-to-point predictive model for reliably and presumptively determining the ability of individual locations to receive signals in accordance with the signal intensity standard in effect under section 119(d)(10)(A) of title 17, United States Code. In prescribing such model, the Commission shall rely on the Individual Location Longley-Rice model set forth by the Federal Communications Commission in Docket No. 98-201 and ensure that such model takes into account terrain, building structures, and other land cover variations. The Commission shall establish procedures for the continued refinement in the application of the model by the use of additional data as it becomes available.[6]

The accompanying Conference Report, which is entitled to "great deference,"[7] provides important guidance both with respect to the modification of the ILLR model and with respect to the

---

[3] *Id.* at ¶ 8.

[4] *Id.* at ¶ 65.

[5] *Id.* at ¶ 77.

[6] 47 U.S.C. § 339(c)(3).

[7] *RJR Nabisco, Inc. v. United States*, 955 F.2d 1457, 1462 (11th Cir. 1992).

interpretative framework of the Act overall. Thus, with regard to modifying the ILLR model, the Conference Committee recognized that the Commission's goal should be *to attempt* to increase the ILLR model's accuracy and that the measure of success in any such revision is whether the model's predictions—with the modifications vis-à-vis without the modifications—are closer to the results of actual field testing:

> Section 339(c)(4) [sic; *read* Section 339(c)(3)] addresses the ILLR predictive model developed by the Commission in Docket No. 98-201. The provision requires the Commission *to attempt to increase its accuracy* further by taking into account not only terrain, as the ILLR model does now, but also land cover variations such as buildings and vegetation. If the Commission discovers other practical ways to improve the accuracy of the ILLR model still further, it shall implement those methods as well. The linchpin of whether particular proposed refinements to the ILLR model result in greater accuracy is whether the revised model's predictions are closer to the results of actual field testing in terms of predicting whether households are served by a local affiliate of the relevant network.[8]

The statute's language that the Commission "ensure that such model takes into account terrain, building structures, and other land cover variations" is not rendered nugatory by the Conference Committee's statement that the provision only requires the Commission *to attempt* to increase the model's accuracy by taking into account land cover variations. This is because, as Network Affiliates argued in CS Docket No. 98-201, Longley-Rice is a semi-empirical model whose empirical foundations, based on data collected from mobile runs, necessarily incorporate whatever vegetation and buildings existed at the time of the mobile runs.[9] Therefore, from a

---

[8] Conference Report at 12 (emphasis added).

[9] *See SHVA Order* at ¶ 82 & n.209; Supplemental Information of the Affiliate Associations, CS Docket No. 98-201 (filed Jan. 15, 1999), at 2-3. *See also* G.A. Hufford *et al.*, *A Guide to the Use* (continued...)

technical perspective, the ILLR model already takes into account "building structures[] and other land cover variations," and the statute's requirement to do so is already fulfilled.[10] The fact that Longley-Rice is semi-empirical and incorporates the then-existing clutter in the model is well-recognized in the scientific and technical community.[11]

Additional guidance on the meaning of Section 339(c)(3) is provided by the floor statement of Senator Leahy:

> Whether a proposed modification to the ILLR model makes

---

[9](...continued)
of the ITS Irregular Terrain Model in the Area Prediction Mode, NTIA Report 82-100 (U.S. Dep't of Commerce Apr. 1982) ["Longley-Rice Manual"], at 12 ("The data used in developing the empirical relations have clearly influenced the model itself. It should then be noted that these data were obtained from measurements made with fairly clear foregrounds at both terminals. In general, ground cover was sparse, but some of the measurements were made in areas with moderate forestation. The model, therefore, includes effects of foliage, but only to the fixed degree that they were present in the data used.")

[10] This interpretation of SHVIA does not render the statutory language superfluous as SHVIA expressly directs the Commission to prescribe a predictive model with the characteristics of the ILLR model. Prior to SHVIA, the Commission in CS Docket No. 98-201 had only *recommended* the acceptance of the ILLR model for SHVA purposes. Now the Commission must formally adopt such a model. The language in Section 339(c)(3) serves as a check on the Commission's discretion to prescribe a predictive model that does not take account of terrain and clutter factors to any extent.

[11] *See, e.g.*, R. Grosskopf, *Comparison of Different Methods for the Prediction of the Field Strength in the VHF Range*, 35 IEEE TRANS. ON ANTENNAS AND PROPAGATION 852 (July 1987), 852 (stating that in the Longley-Rice model "empirically gained quantities influence the field strength prediction"); M.L. Meeks, *VHF Propagation over Hilly, Forested Terrain*, 31 IEEE TRANS. ON ANTENNAS AND PROPAGATION 483 (May 1983), 488 (recognizing the semi-empirical nature of the Longley-Rice model and the fact that if affects the model's prediction of propagation loss); M.M. Weiner, *Use of the Longley-Rice and Johnson-Gierhart Tropospheric Radio Propagation Programs: 0.02-20 GHz*, 4 IEEE J. ON SELECTED AREAS IN COMMUNICATIONS 297 (Mar. 1986), 297 (stating that Longley-Rice is a "statistical/semi-empirical model[] of tropospheric radio propagation"); *id.* at 299 (stating that it is necessary to take account of vegetation only in the immediate vicinity of the receiving antenna because "knife-edge diffraction by vegetation distant from the antennas is usually included in the semi-empirical methods used for estimating the excess propagation loss").

> it more accurate is an empirical question that the Commission should address by comparing the predictions made by any proposed model against actual measurements of signal intensity. The Commission's analysis should reflect our policy objective: to determine whether a household is—or is not—capable of receiving a signal of Grade B intensity from at least one station affiliated with the relevant network.
>
> The FCC has properly recognized that reducing one type of errors, underprediction, while increasing another type of errors, overprediction, does not increase accuracy, but simply puts a thumb on the scale in favor of one side or the other. The issue under Section 119(a)(2)(B)(ii) is the overall accuracy of the model, as tested against available measurement data, with regard to whether a household is, or is not, capable of receiving a Grade B intensity signal from at least one affiliate of the network in question.[12]

Considering both the Conference Report and Senator Leahy's statement, it is clear that Congress intended for the ILLR model to be modified only if the modifications increase the accuracy of the predictions, as measured against actual field test data.

This interpretation is further bolstered by the amendment made to Section 119 of the Copyright Act by SHVIA. Amended Section 119 states in pertinent part:

> In determining presumptively whether a person resides in an unserved household under subsection (d)(10)(A), a court shall rely on the Individual Location Longley-Rice model set forth by the Federal Communications Commission in Docket No. 98-201, as that model *may* be amended by the Commission over time under section 339(c)(3) of the Communications Act of 1934 *to increase the accuracy* of that model.[13]

Therefore, the Copyright Act itself incorporates Congress's notion that the ILLR model should only

---

[12] 145 Cong. Rec. S15022-23 (daily ed. Nov. 19, 1999) (statement of Sen. Leahy).

[13] 17 U.S.C. § 119(a)(2)(B)(ii)(I) (emphases added).

be modified if the modifications, in fact, increase the model's accuracy.[14] Because Section 119 of the Copyright Act and Section 339 of the Communications Act must be read *in pari materia*,[15] the ILLR model should not be modified unless the Commission is satisfied that any modifications actually increase the predictive accuracy of the model, as confirmed by empirical field data.

In addition to the particularized guidance on the ILLR model provided by the statutes and legislative history, the Conference Report also provides guidance on the interpretative framework of SHVIA from a generalized perspective. In particular, the Conference Committee recognized that the compulsory copyright license granted by Congress is in derogation of the exclusive rights of local broadcast stations and therefore must be narrowly construed:

> [T]he Conference Committee is aware that in creating the compulsory licenses, it is acting in derogation of the exclusive property rights granted by the Copyright Act to copyright holders, and that *it therefore needs to act as narrowly as possible* . . . . [A]llowing the importation of distant or out-of-market network stations in derogation of the local stations' exclusive right—bought and paid for in market-negotiated arrangements—to show the works in question undermines those market arrangements. Therefore, the specific goal of the [Section] 119 license, which is to allow for a life-line network television service to those homes beyond the reach of their local television stations, must be met by only allowing distant network service to those homes which cannot receive the local network television stations. Hence, the "unserved household" limitation that has been in the license since its inception. The Committee is mindful and respectful of the interrelationship between the communications

---

[14] *See* Conference Report at 6 (qualifying modifications to the ILLR model to occur only "when the FCC amends the ILLR model to make it more accurate").

[15] *See, e.g.*, *Erlenbaugh v. United States*, 409 U.S. 239, 244 (1972) (stating that the rule of *in pari materia* "makes the most sense when the statutes were enacted by the same legislative body at the same time").

> policy of "localism" outlined above and the property rights considerations in copyright law, and seeks a proper balance between the two.[16] (Emphasis supplied)

When the statutes, Conference Report, and other legislative history are read together, it becomes clear that the principles the Commission recognized and respected in CS Docket No. 98-201 must continue to be the pole star in the instant proceeding. Therefore, in attempting to modify the ILLR model to further take into account the effects of vegetation and buildings on signal intensity at individual locations, the Commission's approach must strive to avoid any underprediction of service. Any doubt or ambiguity as to the model's predictions should be interpreted in favor of service, i.e., in favor of protecting the local station's exclusive property rights. Finally, modifications should not be made if they, in fact, do not improve upon the predictive ability of the current ILLR model, as measured against the results of actual field testing.

II. There Are Numerous Methodological Problems With The *Notice*'s Proposed Clutter Loss Values

The *Notice*'s approach is not so much a modification of the ILLR model itself as it is a method to add (really it is to subtract) a "fudge factor" to take account of the effects of clutter. The *Notice*'s proposal to calculate the field strength at an individual location is expressed as follows[17]:

Field = (Free Space Field) - (Longley-Rice 1.2.2 Path Loss) - (ILLR Clutter Loss)

The *Notice* proposes that the Clutter Loss value for any particular location be taken from a table

---

[16] Conference Report at 2 (emphasis added).

[17] *See Notice* at A-2.

providing clutter loss factors based on the clutter category assigned to each point along the propagation path for four bands of television frequencies (low VHF, channels 2-6, 54-88 MHz; high VHF, channels 7-13, 174-216 MHz; "low" UHF, channels 14-36, 470-608 MHz; "high" UHF, channels 38-69, 614-806 MHz). This table, in turn, is based exclusively on data published by T.N. Rubinstein, with an extrapolation for low VHF frequencies based on trends developed by Y. Okumura.[18]

The accompanying Engineering Statement of the IIT Research Institute, Center for Electromagnetic Science ("IITRI Engineering Statement"), attached hereto as an Appendix, discusses in detail the methodological problems of basing clutter loss values for purposes of refining the ILLR model on the data contained in Rubinstein's paper. The following summarizes and analyzes the principal methodological defects:

1. Receiving Antenna Height. Although Rubinstein does not specify the height of the receiving antennas on his survey vehicles, because the antennas were placed on vehicles and tests conducted along city streets, it is reasonable to assume that their height is between 1.5 meters and 3 meters. There is a significant height gain effect for receiving antennas at 6 meters and 9 meters, which are the assumed heights for household television antennas.[19] In other words, the clutter loss is substantially less than Rubinstein's data would suggest for receiving antennas at *rooftop* level vis-

---

[18] *See Notice* at A-6; T.N. Rubinstein, *Clutter Losses and Environmental Noise Characteristics Associated with Various LULC Categories*, 44 IEEE TRANS. ON BROADCASTING 286 (Sept. 1998); Y. Okumura et al., *Field Strength and Its Variability in VHF and UHF Land-Mobile Radio Service*, 16 REV. OF THE ELEC. COMM. LAB. 825 (Sept.-Oct. 1968).

[19] *See, e.g.*, A.G. Longley, *Radio Propagation in Urban Areas*, CONF. REC. 28TH IEEE VEHICULAR TECH. CONF. 503 (Denver, Colo., Mar. 22-24, 1978), 504.

à-vis *vehicle* level.

In particular, based on Okumura's empirically-derived curves, M. Hata has both plotted the receiving antenna height gain factor and developed formulas that closely approximate these curves.[20] Hata's plot is attached hereto as Exhibit 1. Hata's receiving antenna height gain correction factors are expressed as follows[21]:

Correction factor for receiving antenna height gain, medium-small city:

$$a(h_m) = (1.1 \cdot \log_{10} f_c - 0.7) \cdot h_m - (1.56 \cdot \log_{10} f_c - 0.8)$$

Correction factor for receiving antenna height gain, large city:

if $f_c \leq 200$ MHz, $\quad a(h_m) = 8.29 \cdot (\log_{10} 1.54\, h_m)^2 - 1.1$

if $f_c \geq 400$ MHz, $\quad a(h_m) = 3.2 \cdot (\log_{10} 11.75\, h_m)^2 - 4.97$

Utilizing these formulas, antenna height gain correction factors for raising the receiving antenna height from 3 meters to 6 meters and from 3 meters to 9 meters in both medium-small cities and large cities can be determined, as illustrated in accompanying Tables 1 and 2.[22]

---

[20] *See* M. Hata, *Empirical Formula for Propagation Loss in Land Mobile Radio Services*, 29 IEEE TRANS. ON VEHICULAR TECH. 317 (Aug. 1980).

[21] M. Hata, *Empirical Formula for Propagation Loss in Land Mobile Radio Services*, 29 IEEE TRANS. ON VEHICULAR TECH. 317 (Aug. 1980), 324.

[22] The frequencies are based on the three frequencies tested by Rubinstein for high VHF, "low" UHF, and "high" UHF; 66 MHz (channel 4) was chosen for low VHF as it is in the middle of the low VHF band.

Receiving Antenna Height Gain in Medium-Small City (Hata) **Table 1**

		Frequency (MHz)			
		66	162	460	860
Gain	3m → 6m	3.9	5.2	6.7	7.6
(dB)	3m → 9m	7.8	10.4	13.4	15.2

Receiving Antenna Height Gain in Large City (Hata) **Table 2**

		Frequency (MHz)			
		66	162	460	860
Gain	3m → 6m	4.1	4.1	3.3	3.3
(dB)	3m → 9m	7.1	7.1	5.5	5.5

Longley has also discussed the antenna height gain that is due to raising the receiving antenna height from 3 meters, typical for land mobile services, to 10 meters, typical for television broadcast service:

> The median gain when the receiving antenna is raised from 3 to 10 m depends on the frequency and surface features. In the range of 40 to 100 MHz the height gain is 9 to 10 dB in both rural and urban areas. For frequencies of 150 to 250 MHz the height-gain is 10 to 11 dB in urban or hilly areas, and about 7 dB in flat terrain. At 450 to 1000 MHz the height gain is 14 dB in urban areas and 6 to 7 dB in the suburbs, while in irregular terrain it depends on terrain irregularity, going from 10 to 0 dB as the interdecile range of terrain elevation increases from 10 to 500 m. At any specific location the actual height gain on raising the receiving antenna from 3 to 10 m may be quite different from these median values. As the receiving antenna is raised above surface obstacles a further height gain is to be expected. In an urban area, with receiving antennas above local roof levels no increase in transmission loss above that in rural areas is expected at

> frequencies below 100 MHz. . . . When the receiving antenna is lowered from 3 to 1.5 m the additional attenuation is approximately 3 dB.[23]

Based on both Hata and Longley, it appears that the antenna height gain to be expected from raising the receiving antenna height from 3 meters to 6 meters is approximately 4 dB for VHF frequencies and 5 dB for UHF frequencies and the antenna height gain to be expected from raising the receiving antenna height from 3 meters to 9 meters is approximately 7-8 dB for VHF frequencies and 8-9 dB for UHF frequencies. To the extent that Rubinstein's data were obtained at a receiving antenna height less than 3 meters, additional gain (on the order of 1 or 2 dB) is also likely. In other words, Rubinstein's clutter loss values overstate the effect of clutter loss by at least 4 dB for single-story dwellings and at least 7 dB for two-story (and higher) dwellings.[24]

2. Transmitting Antenna Height. Again, Rubinstein does not specify the height of the transmitting antennas used in his experimental runs. However, because Rubinstein's method was particularly concerned with land mobile communications, it may, again, be presumed that Rubinstein's transmitting antennas were wireless communications antennas at a typical height of 50 meters.[25] An additional gain can be expected for the transmitting antennas of television stations

---

[23] A.G. Longley, *Radio Propagation in Urban Areas*, CONF. REC. 28TH IEEE VEHICULAR TECH. CONF. 503 (Denver, Colo., Mar. 22-24, 1978), 504.

[24] It is worth noting that these estimates are the *minimum* likely effects of adjusting for receiving antenna height. These estimates, therefore, represent very conservative adjustments to Rubinstein's data. However, as pointed out above, the Commission should act in this proceeding to protect local broadcast stations' copyright interests and, accordingly, must ensure that service is not *under*predicted.

[25] The fact that Rubinstein failed to specify the transmitting antenna heights is very problematic for purposes of attempting to derive clutter loss values from his data. There is no way (continued...)

located at heights up to 600 meters.[26] In other words, the clutter loss is less for television broadcast stations than Rubinstein's data suggest for land mobile applications.

Okumura presents empirically derived curves that illustrate the effect of different transmitting antenna heights on field strength at various distances from the transmitting antenna site. An example of such a curve, at 453 MHz, is attached hereto as Exhibit 2. Based on these curves, Hata has developed terms that account for different transmitting antenna heights. In determining propagation path loss, the only terms that depend on transmitting antenna height are expressed as follows[27]:

---

[25](...continued)
to know whether the transmitting antennas for the three different frequencies in each locale were from the same site at approximately the same height or whether they are each different. Similarly, there is no way to know whether the transmitting antenna at, for instance, 162 MHz, was at the same height in Atlanta as it was in Whatcom County, although that is unlikely. However, if the transmitting antenna heights for the same frequency in each of the four different locales are not the same, then the clutter loss measured in each locale cannot merely be added together and averaged. Thus, it would be inappropriate for Rubinstein to have merely combined his San Diego and Los Angeles data together unless either the transmitting antenna heights were the same in the two locations or an adjustment to the data was made. However, it appears that that is what Rubinstein did, which calls into question all of his measurement results. Overall, with three different frequencies in four different locations, Rubinstein's data may reflect 12 different transmitting antenna heights.

For the sake of argument, and in order to show the likely effect of accounting for transmitting antenna height gain, the text assumes that all of the transmitting antennas in Rubinstein's experiment were at 50 meters. However, even if this assumption of a 50 meter transmitting antenna height be incorrect, the argument in the text shows how the height gain may be determined for different heights, and, more importantly, the force of the argument, viz. that Rubinstein's clutter loss values need to be adjusted to account for transmitting antenna height gain, remains the same.

[26] *See, e.g.*, Y. Okumura et al., *Field Strength and Its Variability in VHF and UHF Land-Mobile Radio Service*, 16 REV. OF THE ELEC. COMM. LAB. 825 (Sept.-Oct. 1968); M. Hata, *Empirical Formula for Propagation Loss in Land Mobile Radio Services*, 29 IEEE TRANS. ON VEHICULAR TECH. 317 (Aug. 1980).

[27] M. Hata, *Empirical Formula for Propagation Loss in Land Mobile Radio Services*, 29 IEEE TRANS. ON VEHICULAR TECH. 317 (Aug. 1980), 324.

$$- 13.82 \cdot \log_{10} h_b + (44.9 - 6.55 \cdot \log_{10} h_b) \cdot \log_{10} R,$$

where R is the distance from the transmitting antenna in kilometers.

Based on these terms, the gain that may be attributed to raising the transmitting antenna height from 50 meters to 200 meters is shown in Table 3[28]:

Transmitting Antenna Height Gain (Hata) **Table 3**

		Distance (km)				
		20	40	60	80	100
Gain (dB)	50m → 200m	13.5	14.6	15.3	15.8	16.2

Although distance has a slight effect on the transmitting antenna height gain, by raising the transmitting antenna height from 50 meters to 200 meters the typical gain appears to be about 15 dB.

Longley states that she compared Okumura's model with the Longley-Rice model and found that the two models show little difference as the transmitting antenna height is increased from 30 meters to 600 meters.[29] Therefore, the figures shown in Table 3 may be taken as a fair representation of the gain that would be found in the Longley-Rice model itself.

---

[28] Hata limits the applicability of his formula to base station effective antenna heights between 30 meters and 200 meters. *See* M. Hata, *Empirical Formula for Propagation Loss in Land Mobile Radio Services*, 29 IEEE TRANS. ON VEHICULAR TECH. 317 (Aug. 1980), 324. However, Okumura's study contains curves for a base station effective antenna height of 820 meters, *see* Y. Okumura et al., *Field Strength and Its Variability in VHF and UHF Land-Mobile Radio Service*, 16 REV. OF THE ELEC. COMM. LAB. 825 (Sept.-Oct. 1968), 836-38, and it appears that Hata's formula nearly approximates the likely increased gain as one moves above 200 meters.

[29] *See* A.G. Longley, *Radio Propagation in Urban Areas*, CONF. REC. 28TH IEEE VEHICULAR TECH. CONF. 503 (Denver, Colo., Mar. 22-24, 1978), 506.

The Commission's own rules contain propagation curves showing the field strength at different transmitting antenna heights for various distances from the transmitting site.[30] These curves are not restricted in range the way Hata limited the applicability of his formula. In Zone I, the typical transmitting antenna height for a television station may be taken as approximately 300 meters; in Zone II and Zone III, the typical transmitting antenna height for a television station may be taken as approximately 500 meters. Taking a moderate distance from the transmitting site as 60 kilometers, it is possible to derive gains due to increasing transmitting antenna height from the Commission's curves as shown in Table 4:

Transmitting Antenna Height Gain (FCC) **Table 4**
At Distance of 60 Kilometers

		Low VHF	High VHF	UHF
	50m → 200m	11.5	12	11
Gain (dB)	200m → 300m	3.5	4	5
	200m → 500m	8.5	10	11

Although the FCC-derived gain due to increasing the transmitting antenna height from 50 meters to 200 meters is about 3 to 4 dB less than that found by Okumura-Hata-Longley, the difference is probably attributable to the clutter that the latter take into account vis-à-vis the Commission's methodology. In other words, as the transmitting antenna height is increased, more clutter is cleared (i.e., the elevation angle increases).

In addition, as Table 4 demonstrates, as one attains transmitting antenna heights typical of

[30] *See* 47 C.F.R. § 73.699, Fig. 9, Fig. 10, Fig. 10b. In these curves, the receiving antenna height is 9 meters.

television stations, there is an even greater gain factor to consider. Thus, for typical Zone I television station transmitting antenna heights, Rubinstein's clutter loss values need to be lowered by at least 15-16 dB. For typical Zone II or Zone III television station transmitting antenna heights, Rubinstein's clutter loss values need to be lowered by at least 20-22 dB. These are substantial modifications to Rubinstein's data that need to be considered if the Commission proposes to derive clutter loss values for importation into the ILLR model.

3. Polarization And Other Antenna-Type Differences. The receiving antennas used by Rubinstein were mobile, nondirectional, non-optimized monopole antennas receiving vertically-polarized signals. By contrast, a television receiving antenna is typically a fixed, directional dipole or multi-element antenna, optimized on the roof towards the transmitting antenna, receiving horizontally-polarized signals. As Longley herself has noted, "at 100 MHz the average loss from nearby trees was 5 to 10 dB with vertical polarization and only 2 to 3 dB for horizontally polarized signals."[31] In addition, she has stated that "[w]ith the transmitting antenna at a clear site," which is typical of television transmitting antennas, "the polarization discrimination at rooftop level in an urban area has a 90% value of about 9 dB. Some measurements at UHF indicate that there is slightly more depolarization for vertically than for horizontally polarized waves."[32] Therefore, simply due to polarization itself, the Rubinstein clutter loss values are too high by 3 to 9 dB.

Furthermore, Rubinstein's data is tainted by multipath that is significantly more likely to affect a low, mobile vertical antenna than a fixed, roof-top antenna. Rubinstein's antennas were

---

[31] A.G. Longley, *Radio Propagation in Urban Areas*, CONF. REC. 28TH IEEE VEHICULAR TECH. CONF. 503 (Denver, Colo., Mar. 22-24, 1978), 504.

[32] *Id.*

simply susceptible to more man-made effects than a television receiving antenna located at rooftop level and properly oriented toward the transmitting antenna.

4. Fresnel Zone Clearance. Although Rubinstein states that he did not survey any shadowed locations, i.e., locations without Fresnel zone clearance,[33] physical theory belies that claim. With receiving antennas located at vehicle-top height, Rubinstein's antennas were simply too close to the ground to have ever achieved first Fresnel zone clearance. Especially at 162 MHz, Rubinstein could never have achieved Fresnel zone clearance at any distance from the transmitter. Moreover, other vehicles passing Rubinstein's survey vehicles would have prevented Fresnel zone clearance at each of the other two frequencies (460 MHz and 860 MHz). Therefore, Rubinstein's data are fundamentally contaminated because he did not have full Fresnel zone clearance as he supposed. The effect of this contamination is to raise improperly Rubinstein's clutter loss values by approximately 4 to 5 dB, an effect that must be subtracted out.[34]

5. Extrapolation To Low VHF Frequencies. Rubinstein did not collect data for low VHF frequencies, as the *Notice* recognizes. To overcome that defect, the *Notice* proposes clutter loss values for low VHF that are based upon an extrapolation of Rubinstein's data derived from trends developed by Okumura.[35] Because the *Notice*'s method of extrapolation is not further detailed, this

---

[33] *See* T.N. Rubinstein, *Clutter Losses and Environmental Noise Characteristics Associated with Various LULC Categories*, 44 IEEE TRANS. ON BROADCASTING 286 (Sept. 1998), 287-88.

[34] *See, e.g.*, GTE Lenkurt, Inc., ENGINEERING CONSIDERATIONS IN MICROWAVE COMMUNICATIONS SYSTEMS (1970) (demonstrating that where the reflection coefficient is -0.3, which is common for many paths, the loss due to lack of first Fresnel zone clearance varies nearly linearly from 0 dB at 0.6 Fresnel clearance to 10 dB at 0 clearance).

[35] *See Notice* at ¶ 12 and A-6.