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

In the Matter of	)	
Establishment of a Model for Predicting Digital Broadcast Television Field Strength Received at Individual Locations	)	ET Docket No. 10-152
Measurement Standards for Digital Television Signals Pursuant to the Satellite Home Viewer Extension and Reauthorization Act of 2004	)	ET Docket No. 06-94

JOINT COMMENTS OF DIRECTV, INC. AND DISH NETWORK L.L.C.

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August 24, 2010

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I. INTRODUCTION AND SUMMARY

DIRECTV, Inc. ("DIRECTV") and DISH Network L.L.C. ("DISH" or "DISH Network") commend the speed at which the Commission is proceeding to implement the rulemakings required by the Satellite Television Extension and Localism Act of 2010 ("STELA"),[1] to ensure compliance with the 270-day deadline that Congress has imposed for final orders. While the deadline is tight, the Commission needs to effectuate the congressional intent of STELA, and nothing less will be enough.

In its effort to discern Congress's intent, the Commission correctly identifies in the *Notice* the changes STELA made to the previous law, including the key change in the definition

[1] Establishment of a Model for Predicting Digital Broadcast Television Field Strength Received at Individual Locations, ET Docket Nos. 10-152, 06-94, *Notice of Proposed Rulemaking and Further Notice of Proposed Rulemaking*, FCC 10-133, (rel. July 28, 2010) ("*Notice*"); *see also* The Satellite Television Extension and Localism Act of 2010, Pub. L. No. 111-175, § 203 ("STELA"). The first rulemaking was the Implementation of Section 203 of the Satellite Television Extension and Localism Act of 2010 (STELA), MB Docket No. 10-148, *Notice of Proposed Rulemaking*, FCC 10-130 (rel. July 23, 2010).

of "unserved household."[2] Previously, a household was unserved, and therefore qualified to receive distant stations by satellite, only if it could not receive a signal of sufficient strength by means of a very specific type of antenna: a "conventional, stationary, outdoor rooftop receiving antenna." These qualifiers have all been deleted by STELA. Plainly, a household is now unserved, and therefore eligible to receive distant stations, if it cannot receive a signal of sufficient strength by means of a simple indoor antenna, an antenna of the type used by most consumers for over-the-air reception. In case there were any doubts about the meaning of the deletion, the law's legislative history confirms it: "The Committee expects the Commission to consider the types of antennas that are readily available for purchase by consumers to receive the signals of local digital television broadcast stations over-the-air."[3]

In making this change, Congress was responding to a simple reality: the advent of the DTV transition has made indoor "rabbit ears" reception antennas even more overwhelmingly prevalent than they already were. Notably, the Commission itself has encouraged consumers to content themselves with rabbit ears indoor antennas. Consumers have heeded this recommendation in numbers that cannot be ignored.

To its credit, the *Notice* highlights the statutory change and acknowledges in principle the need for corresponding change both to the predictive model and to the measurement to be used for determining whether a household is unserved. But curiously, the *Notice* stops at this theoretical acknowledgement, and still proposes to base both predictive model and measurement method upon the unrealistic, outdated (and now unauthorized) assumption of a gigantic directional antenna towering over the consumer's house in a 1950s cityscape. It makes only a

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[2] *Notice* ¶ 10.

[3] H.R. Rep. No. 111-349, at 19 (2009).

few nods to the possibility of change. As these comments and the accompanying report from DIRECTV's and DISH's engineering expert Christopher Kurby[4] demonstrate, more is necessary.

- The predictive model should be based on the use of an indoor half-wave dipole. There is no need to adapt the predictive model to the circumstances of each individual household. For now, it is enough to assume a uniform lower height and subtract an appropriate correction factor to account for the additional obstructions encountered by indoor reception.

- At a minimum, these adjustments to the predictive model should be made for all consumers who do not have an outdoor rooftop antenna.

- The Commission should incorporate much more granular factors to reflect obstructions associated with land use and land cover. Today, the ILLR model makes no adjustment at all for VHF signals, as if these signals propagated in perfectly open space. Available information on land use and clutter will also avoid overpredictions as well as underpredictions – an improvement all around. In the era of Google Earth, it is no longer acceptable for the model to content itself with a blunt tool such as the Land Use Land Cover ("LULC") database of the U.S. Geological Service. As an alternative, the Commission should consider adjusting the LULC database to compensate for the increased obstructions associated with lower antenna height.

- The predictive model should be based on 99% time variability instead of 90%. In other words, a household should not count as served unless it is predicted to receive a signal of sufficient strength 99% of the time. The Commission cites several reasons for rejecting this change in 2005. These reasons have been overtaken by yet another change made by STELA: to qualify a carrier as providing local service to a new DMA with a good quality signal, the new law requires signal availability of 99.7%. This number is not talismanic – Congress merely codified its view of what consumers expect. Reception of broadcast signals should not be held to a lower standard.

- The model should be revised to reflect interference from neighboring broadcast stations.

- To address multipath interference, a 3dB correction should be applied in the short term. In the longer term, the model should be revised to more fully reflect the effects of multipath interference.

[4] Engineering Analysis and Statement of Christopher Kurby, ET Docket Nos. 10-152 and 06-94 (filed Aug. 24, 2010) (attached hereto) ("Kurby Report").

As with the predictive model, the Commission acknowledges on a theoretical level that the deletion of the "outdoor" antenna requirement has implications for the measurement method, too. But here again, the *Notice* stops short of recommending changes, except at the margin. There is no question that Congress intended to permit indoor testing.

- The Commission should establish a protocol for indoor antenna testing. Mr. Kurby recommends such a protocol in his report. The rules recommended by Mr. Kurby would resolve the difficulties cited by the Commission in connection with testing in constrained indoor spaces. Mr. Kurby's report demonstrates that none of these difficulties is insuperable.

- At a minimum, this indoor strength test should be permitted for consumers who do not have an outdoor antenna.

- The Commission should also permit a "reception" test – testing, that is, whether the household can lock on to a viewable signal, no matter how strong it is. It is true that, at first blush, the statute appears to contemplate a strength test. Closer review, however, casts doubt on that reading. For a household to be served, not only does the signal need to be of sufficient strength, the household must be able to "receive" the signal in the first place. "Receive," then, can be read to denote a separate element of the standard, and an antecedent element at that. Under this reading, a household would first and foremost need to receive a viewable signal to count as served. Only if it receives such a signal in the first place does the strength of the signal become relevant. The Commission should thus also permit a "reception" test – testing, that is, whether the household can lock on to a viewable signal, no matter how strong it is.

This reading is buttressed by the policy underlying the unserved household standard in the first place. Congress wanted people who could not watch their local network programming over the air to be able to receive a distant station affiliated with the same network. To create a fiction that a consumer receives the local programming if he can see nothing on his screen disserves that objective. That fiction may have been inevitable in the analog world, when the question of whether reception is adequate was necessarily fraught with subjectivity. It is both avoidable and no longer tenable after the digital transition in the world of zeroes and ones. Today, a household either gets a

picture over the air, or it does not. Mr. Kurby describes a simple test for whether a household can receive a viewable signal in the first place.

Ostensibly, this rulemaking is about hypertechnical issues – confidence intervals, time variability, measurement clusters, and the like. All of these technicalities, however, are connected umbilically with a much more fundamental question – enfranchising consumers by allowing them to receive programming that they cannot watch over the air and conversely, avoiding the disenfranchising of consumers based on unrealistic predictions and measurements. Predictions and measurements using an indoor antenna will satisfy this overarching public interest criterion as well as fulfill Congress's intent.

II. THE COMMISSION SHOULD GIVE EFFECT TO CONGRESS'S CHANGES TO THE "UNSERVED HOUSEHOLD" DEFINITION

For more than twenty years, Section 119 of the Copyright Act has contained a statutory license for satellite carriers to offer out-of-market, "distant" network broadcast signals to so-called unserved households.[5] An "unserved household," in turn, was one that could not receive an off-air signal of a particular strength[6] from a same-network local station "through the use of a conventional, stationary, outdoor rooftop receiving antenna."[7]

For nearly as long as this provision has existed, consumers have complained that the "unserved household" eligibility provision – and particularly, its reliance on outdoor rooftop

[5] 17 U.S.C. § 119(a)(2).

[6] As discussed below, for analog signals the requisite strength is that of "Grade B intensity." Congress recently amended the law to provide that, for digital signals, the requisite strength is that used to determine a station's noise-limited contour. 17 U.S.C. § 119(d)(10)(A).

[7] 17 U.S.C. § 119(d)(10)(A) (2006) (amended 2010). The word "stationary" was added to this definition in 1999; it has otherwise remained unchanged since 1988.

antennas – was highly unrealistic.[8] Because most people do not use outdoor rooftop antennas, an "unserved household" standard referencing such antennas necessarily leaves ineligible for distant signals households that cannot actually receive adequate local signals over the air.[9] Yet the Commission had somewhat understandably been reluctant to consider the use of non-outdoor antennas in determining "unserved household" eligibility, because it viewed its hands as tied by the statute's "conventional, stationary, outdoor rooftop antenna" language.[10] Accordingly, both the models the Commission promulgated for predicting eligibility and the testing methodology it adopted for definitively determining eligibility have consistently assumed the use of outdoor, rooftop antennas.[11]

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[8] *See, e.g.*, Comments of DIRECTV, Inc., CS Docket No. 98-201, at 18 (filed Dec. 11, 1998) ("The Commission's current Grade B signal strength values are based upon planning standards and signal propagation assumptions that are clearly outdated, and the validity of the assumptions that underlie them have been questioned for decades."); Comments of EchoStar Communications Corp., CS Docket No. 98-201, at iv (filed Dec. 11, 1998) ("The signal strength that the consumer actually receives at his/her television set, with all the imperfections of his/her conventional equipment, is the relevant criterion for determining whether the consumer should be eligible for distant network service.").

[9] The Commission notes as much in this proceeding. *See Notice* ¶ 23 ("Using the outdoor model may result in instances where a consumer who either cannot use an outdoor antenna or cannot receive service using an outdoor antenna and is not able to receive a station's service with an indoor antenna will be found ineligible for satellite delivery of a distant network signal.").

[10] *See* Satellite Delivery of Network Signals to Unserved Households for Purposes of the Satellite Home Viewer Act, *Report and Order*, 14 FCC Rcd. 2654, 2679-80 ¶ 52 (1999) ("*SHVA Report and Order*") ("Although we recognize, as the satellite carriers argue, that measurements taken at the television receiver would most accurately reflect the picture that a consumer watches, such an approach would be inconsistent with the intent of the SHVA, which requires the use of an outdoor rooftop antenna."); Satellite Delivery of Network Signals to Unserved Households for Purposes of the Satellite Home Viewer Act, *Order on Reconsideration*, 14 FCC Rcd. 17373, 17379-80 ¶¶ 14-15 (1999); *Report to Congress: Study Of Digital Television Field Strength Standards And Testing Procedures* in ET Docket No. 05-182, 20 FCC Rcd. 19504, 19569 ¶ 147 (2005) ("*2005 SHVERA Report*") (declining to account for in-building interference because of statutory standard requiring use of "outdoor" antenna).

[11] *See Notice* ¶ 6 (analog methodology); *id.* ¶ 8 (digital predictive model); *id.* ¶¶ 33-34 (testing methodology).

A. In the Digital Television Era, Consumers Use Indoor Antennas Even More Overwhelmingly than in the Past

With the advent of digital television, what was always a disconnect between statutory language and consumer practice took on dimensions that it was no longer possible to ignore. When broadcast service was switched from analog to digital transmission, very few consumers who previously had outdoor antennas commissioned the erection of a new, expensive, and awkward DTV antenna on their rooftop to replace their equally awkward analog contraption. Instead, most moved their reception capability indoors. This was due to several factors. The underlying technology for the indoor antennas has continued to improve. In areas of the country with frequent lightning storms, many viewers do not install the antenna towers or masts because they present a hazard during storms.[12] Viewers in apartment or townhouse buildings are often limited to using exterior balconies or patios for antennas, which may allow for the installation of small satellite dishes but not "fringe" TV receiving antennas.[13]

While the quality of indoor antennas is improving by leaps and bounds, outdoor antennas have remained as difficult to install and as cumbersome for individuals to maintain without professional assistance as they always (and notoriously) had been. And there are fewer and fewer technicians available to install these antennas.[14]

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[12] Comments of EchoStar Satellite L.L.C, Exhibit 2: Statement of Hammett & Edison, Inc., Consulting Engineers, FCC Docket No. 06-94, at 6 (filed Aug. 7, 2006) ("H&E Report").

[13] *Id.*

[14] *See* ConsumerReports.org, How to Survive the Digital TV Transition (Feb. 2008), *available at* http://www.consumerreports.org/cro/electronics-computers/news-electronics-computers/pulling-the-plug-on-analog-tv-206/ ("Although professional antenna installation was once a common service, finding an installer today might not be as easy as finding someone to wire a home computer network. None of the major electronics chains our reporter called (BestBuy, Circuit City, and Sears) install outdoor antennas.").

Furthermore, the introduction of satellite local-into-local service has meant that, not only cable subscribers,[15] but now most satellite subscribers, too, have little reason to receive their local service over the air. They receive it from their multi-channel video program distributor instead. This has made outdoor antennas even more redundant than they already were.

Finally, and crucially, consumers have been encouraged to content themselves with an indoor antenna by repeated endorsements of this mode of reception coming from no less authoritative a source than the Commission.[16] That encouragement was correct and appropriate; it also appears to have had the desired effect.

B. Congress Changed the Antenna Standard through STELA

As Congress deliberated renewing the satellite statute last year, the question whether it is appropriate to determine "unserved households" with reference to outdoor rooftop antennas was thus raised with even greater resonance than before. DIRECTV, for example, offered testimony that the National Association of Broadcasters' ("NAB") own website showed that millions cannot currently receive off-air signals; in addition, the antenna.org website effectively estimated that as many as 45% of those predicted to be "served" under the extant version of the

[15] DISH today provides local stations to all 210 Designated Market Areas ("DMA"s). DIRECTV will provide local stations to 172 DMAs by the end of the year. This means in turn that most of the nation's more than 32.5 million Direct Broadcast Satellite ("DBS") subscribers receive some local stations by satellite. In 1999, by contrast, virtually all DBS subscribers had to rely on other means, primarily over-the-air reception, to watch local broadcasts.

[16] *See, e.g.*, Press Release, FCC, Ignorance Is Not Bliss: Debunking Myths About DTV (rel. June 8, 2009) (noting that to get reception "[c]onsumers must have a good antenna with both rabbit ears, or the equivalent for channels 2-13 (VHF) and a loop, bow-tie or equivalent, to get channels 14-51 (UHF)"); Press Release, FCC, Good Antenna Key to Making the Switch (rel. June 6, 2009) ("You're going to need good ears and a bow-tie to make the transition to digital television (DTV) on June 12. Ears, as in rabbit ears of an indoor TV antenna . . . . [a]nd a bow-tie, as in the metal bow-tie or often, a loop, on the antenna . . . .").

ILLR model could not receive signals regardless of the antenna employed.[17] (NAB continues to endorse this judgment, as it instructs users to "learn more about choosing the right antenna" by linking to this site in the event of retransmission consent disputes.)[18]

Faced with this evidence that many households could not receive over-the-air signals but were also ineligible for "distant" network broadcast signals via satellite, Congress last December amended the key "conventional, stationary, outdoor rooftop receiving antenna" language to read, simply, "antenna."[19] A household is now "unserved" if it cannot receive a signal of a particular strength "through the use of an antenna."[20] Thus, Congress finally and definitively interred the prior approach to determining eligibility for distant signals with reference to costly, visually intrusive equipment that most consumers do not have or want.

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[17] *See* Written Testimony of Robert Gabrielli, Senior Vice President, Program Operations, DIRECTV, Inc., Before the Senate Committee on Commerce, Science, and Transportation (Oct. 7, 2009), *available at* http://commerce.senate.gov/public/?a=Files.Serve&File_id=6c1bf04a-bbb5-4ced-8e80-737da650eba7, attached hereto as Exhibit A; *see also* AntennaWeb, FAQ –Are There Some Areas not Suitable for TV antennas?, http://www.antennaweb.org/aw/info.aspx?page=FAQ (explaining that high-rise buildings can cause a severe ghosting problems and obstacles local to a particular household may case interference such that "an antenna may not provide workable reception").

[18] KeepMyTV.Org, *What Else Can I Do to Keep My TV,* http://www.keepmytv.org/what.asp (describing methods for consumers to access local broadcast stations that have withheld retransmission consent to multichannel video programming distributors).

[19] 17 U.S.C. § 119(d)(10)(A)(i) (referencing analog signals of "Grade B intensity"); *id.* § (119)(d)(10)(A)(ii) (referencing digital signals of the "intensity defined in the values for the digital television noise-limited service contour, as defined in regulations issued by the Federal Communications Commission (section 73.622(e) of title 47, Code of Federal Regulations), as such regulations may be amended from time to time").

[20] *Id.*

C. The Commission's Rules Must Give Effect to the Statutory Change

The Supreme Court tells us that "[w]hen Congress acts to amend a statute, we presume it intends its amendment to have real and substantial effect."[21] The removal of language is no exception.[22] Where Congress removes language, it is presumed to have acted "intentionally and purposefully in the disparate inclusion or exclusion."[23] More importantly, where, as here, Congress has removed language not only from the statute but from the previous version of the bill, the courts will "not lightly assume that Congress has omitted from its adopted text requirements that it nonetheless intends to apply."[24] This was the case with the question of video description rules. Two video description bills would have, respectively, required or authorized the Commission to promulgate such rules.[25] The final law deleted those provisions, however, and replaced them with language asking the Commission to conduct a study of video description instead.[26] The D.C. Circuit had no difficulty interpreting the deletion. It meant that the

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[21] *Babbitt v. Sweet Home Chapter of Communities for a Great Oregon*, 515 U.S. 687, 701 (1995).

[22] *See Jama v. Immigration and Customs Enforcement*, 543 U.S. 335, 341 (2005) ("We do not lightly assume that Congress has omitted from its adopted text requirements that it nonetheless intends to apply . . . ."); *Chickasaw Nation v. United States*, 534 U.S. 84, 93 (2001) (noting that courts will "not assume that Congress intended 'to enact statutory language that it has earlier discarded in favor of other language'") (quoting *INS v. Cardoza-Fonseca*, 480 U.S. 421, 443 (1987)).

[23] *See Moshe Gozlon-Peretz v. United States*, 498 U.S. 395, 404 (1990) ("[Where] Congress includes particular language in one section of a statute but omits it in another section of the same Act, it is generally presumed that Congress acts intentionally and purposely in the disparate inclusion or exclusion.") (internal citations omitted); *Russello v. United States*, 464 U.S. 16, 23 (1983) (same).

[24] *Jama*, 543 U.S. at 341.

[25] *Motion Picture Association of America v. FCC*, 309 F.3d 796, 799 (D.C. Cir. 2002).

[26] *Id.*

Commission was not authorized to do what had been taken out of the bill – establish video description rules.[27]

The Commission generally and properly follows these canons in interpreting the acts of Congress.[28] In its recent *Notice of Proposed Rulemaking* dealing with significantly viewed stations, for instance, the Commission used this very tenet of statutory construction to interpret another statutory deletion made in STELA. In the Commission's view, Congress' removal of the words "same network affiliate" from Section 340(b)(2)(A) indicated that the Commission could no longer require that consumers receive the local affiliate before receiving the affiliated, significantly viewed station.[29]

These canons are operative here. By broadening the description of the antenna to be used in determining whether a household is unserved, Congress can only have intended one thing: to permit use of indoor antennas, including so-called "rabbit-ears." Previously, the statute narrowed the type of antenna with a number of qualifiers. The antenna had to be outdoor. It had to be a rooftop antenna. It had to be conventional. It had to be stationary. The removal of these qualifiers has only one possible meaning: antennas that do not meet these characteristics should be permitted for testing.

To its credit, the *Notice* highlights the statutory change and acknowledges in principle the need for change both to the predictive model and to the measurement to be used for determining whether a household is unserved. It states that "Congress's use of the term 'antenna' in the STELA grants the Commission greater flexibility to take into account different types of antennas

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[27] *Id.* at 806.

[28] Implementation of Section 203 of the Satellite Television Extension and Localism Act of 2010 (STELA), MB Docket No. 10-148, *Notice of Proposed Rulemaking*, FCC 10-130, ¶ 16 (rel. July 23, 2010).

[29] *Id.* ¶ 17.

than was previously available."[30] It goes so far as to say that "[t]he prediction model we are proposing addresses the statutory change from an 'outdoor' antenna to an antenna."[31] But curiously, the *Notice* stops there. The Commission tentatively proposes "the current standard for an outdoor antenna" rather than amending that standard to include other antennas.[32] Likewise, the Commission proposes to continue specifying outdoor antennas for signal testing.[33] It makes only a few nods to the possibility of change.

The reason for these conflicting signals seems to be that the *Notice's* proffered statutory interpretation is itself internally inconsistent. Even as it seems to recognize that Congress did not delete the "outdoor" requirement purposelessly,[34] it undoes that recognition by then saying: "we believe that STELA's specification of the signal strength intensity standard incorporated into our rules implies use of an outdoor antenna to receive service."[35] The Commission seems to argue that, since that rule reflects use of an outdoor antenna, perhaps Congress did not intend to change anything after all. That, of course, would mean precisely that the deletion was whimsical and meant nothing, contrary to well-established interpretative canons. Moreover, the Commission assigns too much weight to the citation to its rule for a number of reasons.

First of all, the statute refers to "the values for the digital television noise-limited service contour, as defined in . . . 47 C.F.R. § 73.622(e)."[36] "The values" are just numbers – a way of representing specific decibel levels that are either met or missed by the signal received by a

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[30] *Id.* ¶ 21.

[31] *Id.* ¶ 14.

[32] *Id.* ¶ 20.

[33] *Id.* ¶ 37.

[34] *Id.* ¶ 20.

[35] *Id.*

[36] 17 U.S.C. § 119(d)(2)(10)(A)(ii) (emphasis added).

particular household. Congress, in other words, endorsed a *strength standard*, which does not evidence any congressional intent as to the *method* for predicting or measuring the strength of a signal and determining whether the strength of that particular signal is lower or higher than the standard. One is apples; the other oranges.[37] Even if the signal strength *values* were derived for very different purposes using certain assumptions, the statutory definition of the previously required antenna qualifiers shows that Congress intended that the Commission employ those thresholds for *this* purpose using a different method for determining whether a particular signal meets them.[38]

Indeed, the statutory change may flow directly from the Commission's own treatment of signal strength issues. Five years ago, Congress asked the Commission whether the "noise-limited" standard – *e.g.*, the decibel levels themselves – should be changed in order to address antenna issues.[39] The Commission responded, in part, that the noise-limited standard is a unit of measurement used in other contexts as well and that changing it would affect policies unrelated to distant signal eligibility, such as the power level at which digital stations could operate.[40] Having been told that the standards themselves should not change, Congress quite reasonably concluded that the method should change to track consumers choices and circumstances. This

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[37] 47 U.S.C. § 339(c)(3).

[38] The cited section of the Commission's rules, in turn, references the "noise limited contour" at certain levels "as determined using the method in section 73.625(b)." 47 C.F.R. § 73.622(e). Even if one were to look at "the method" for determining such values cited in the rules, (rather than the values themselves), that "method" (*i.e.*, that contained in 47 C.F.R. § 73.625(b)) says nothing about antenna height and placement.

[39] *See 2005 SHVERA Report* ¶ 21 (citing 47 U.S.C. § 339(c)(1)(B), which asked the Commission to specifically consider "whether to account for the fact that an antenna can be mounted on a roof or placed in a home and can be fixed or capable of rotating").

[40] *See id.* ¶ 43 ("If DTV service were instead based on consideration of indoor reception, then the power levels needed to replicate stations' analog service at distances of 55-60 miles or greater would be substantially higher.").

explains Congress's deletion of "conventional, stationary, outdoor rooftop" that had preceded the word "antenna."

Second, the *Notice* disregards the coda "or a successor regulation" and "as such regulations may be amended from time to time."[41] Congress did not mean to set the Commission's rule, with its reliance on outdoor antennas, in stone. It is the pointed deletion of "outdoor" that prevails over any inferences from the cited Commission rule, as the law expressly says the rule is subject to change, meaning there was no need to remove the citation, too. If the Commission believes that its rule's specification of an outdoor antenna interferes with congressional intent, it should change the rule.

Third, there is yet another apparent, albeit mistaken, reason why the Commission might recognize the importance of the change but then propose not to do much by way of implementation. The Commission notes that DISH Network today serves all 210 local markets. Citing the "no distant where local" rule, the Commission notes correctly that "the circumstances in which a subscriber would need, or be eligible for, distant signals will be significantly reduced."[42] This, again, is no basis on which the Commission can ignore Congress's explicit command. Moreover, both satellite carriers will continue to need to qualify distant signals even after they both provide local service in all 210 local markets.[43]

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[41] 47 U.S.C. § 339(c)(3)(A); 17 U.S.C. § 119(d)(10)(A)(ii).

[42] *Notice* ¶ 12 (citing 47 U.S.C. § 339(a)(2)).

[43] *See, e.g.*, 47 U.S.C. § 339(a)(2)(C) (prohibiting a satellite carrier from offering distant signals to a subscriber only if it "makes available" local signals to that subscriber).

III. THE STATUTORY CHANGES COMPEL CHANGES TO THE PREDICTIVE MODEL

There are a number of technical changes that the Commission should undertake to make the predictive model more consistent with the statutory amendments of STELA and the realities of the marketplace.

The Commission seeks input on the type of antenna to be used and specific standards.[44] DIRECTV and DISH recommend the model be based on the use of an indoor half-wave dipole. There is no need to adapt the predictive model to the circumstances of each individual household. For now, it is enough to assume a uniform lower height and subtract an appropriate correction factor to account for the additional obstructions encountered by indoor reception. Mr. Kurby recommends a height of one meter. As he explains, this height represents the more common height of an antenna used by consumers – a movable indoor dipole for a first floor TV receiver.[45] As for the additional signal losses entailed by indoor reception, Mr. Kurby recommends a total correction of 20dB. As he explains, this is the common fixed factor used by cellular and land mobile coverage calculations at 700MHz and 90% confidence to account for building loss.[46] An additional correction should be made for households in urban areas. Separately, the ILLR model currently provides a 5-7dB correction for land clutter. While this is probably adequate for suburban environments, this is far from sufficient for urban environments. Mr. Kurby notes that a significant additional correction of 10dB is required in urban areas.[47]

At a minimum, these adjustments to the predictive model should be made for all consumers who do not have an outdoor rooftop antenna. The Commission's tentative

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[44] *Notice* ¶ 23.

[45] Kurby Report at 2.

[46] *Id.* at 4.

[47] *Id.* at 3-4.

consideration of adjustments for consumers who are not able to have such an antenna is unduly narrow.[48] Most consumers could theoretically have an outdoor antenna, but they do not. Congress chose to move away from the previous law's paternalist approach of telling consumers what type of antenna system they should be deploying. A consumer's statement that she does not have an outdoor antenna is enough, easy as it is to check by recourse to Google Earth.

The Commission asks for comment on the appropriate clutter loss values for predicting digital television field strength.[49] The model should take into account specific and granular natural and man-made obstructions, not just rough land use and clutter variables. In the era of Google Earth, it is no longer acceptable for the model to content itself with a blunt tool such as the Land Use Land Cover ("LULC") database of the U.S. Geological Service. This would be true even if the current land use and land clutter variables had a meaningful positive value, which would signify the presence of some land use and clutter. As it is, these variables are artificially set at zero for all VHF frequencies – the frequencies used by most network stations.[50] This amounts to an assumption that, for all VHF stations, land use and clutter do not cause any signal loss whatsoever. That is a plainly unrealistic reflection of the obstructions that TV signals encounter on their voyage to most households. In any event, more granular variables should also avoid overpredictions as well as underpredictions – an improvement all around. As an alternative to developing more granular factors, the Commission should, at a minimum, consider adjusting the LULC database to compensate for the increased obstructions associated with lower antenna height.

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[48] *See Notice* ¶ 23.

[49] *Id.* ¶ 29.

[50] Establishment of an Improved Model for Predicting the Broadcast Television Field Strength Received at Individual Locations, *First Report and Order*, 15 FCC Rcd. 12118, 12126 ¶ 15 (2000).

The Commission seeks comment on the proposal made by EchoStar and Hammett & Edison in 2005 to modify the time variability factor of the SHVIA ILLR model to 99%.[51] Under that proposal, a household should not count as served unless it is predicted to receive a signal of sufficient strength 99% of the time. The Commission cites several reasons for rejecting this change in 2005: the non-linear increases in power required to achieve 99% reliability would result in "greatly" shrinking the local DTV service areas; the lack of available data; and at any rate, the fact that "any actual interruptions of service tend to occur for short periods in a non-consecutive manner."[52]

As for the fear of a significant increase in the number of unserved households, the Commission should reject it or at least discount it, as it was an "end justifies the means" type of defense for the *status quo*. The Commission should not reject improvements to the predictive model to manage the size of the increase in the number of unserved households. The proper criteria are what Congress wanted and what consumers have the right to expect. If, under these criteria, the number of households previously predicted as unserved was too low, the desire to avoid change would enshrine an unduly low number in perpetuity.

Finally, as for the short duration of service interruptions, the objection asserted in the *Notice* does indeed go to the heart of the question: should consumers be asked to accept such interruptions without protest and recourse? It is this question that Congress in STELA answers with a definite "no." Indeed, this, as well as all of the other objections raised in the Notice to the increase in time variability, have been overtaken by yet another change made by STELA: to qualify a carrier as providing local service to a new DMA with a good quality signal, the new

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[51] *Id.* ¶ 24.

[52] *2005 SHVERA Report* ¶¶ 91-92; *Notice* ¶ 27.

law requires signal availability of 99.7%.[53] This number is not talismanic – Congress merely codified its view of what consumers expect. Reception of broadcast signals should not be held to a lower standard. This is especially the case in the new digital environment, unlike analog TV, which is either on or off with processing time in the receiver needed to reconnect and get an adequate picture. Analog signals could still be received with lower picture quality.

DIRECTV and DISH also cannot agree with the *Notice's* proposal to exclude from the model the effects of interference.[54] Interference from stations in neighboring areas is a straightforward source of signal strength loss, and it may well make the difference as to whether a household is served. It is easy to predict, and there is no plausible reason to exclude it. In the longer term, the model should be enhanced to reflect the effects of yet another type of interference – multipath. This issue is a more acute problem for the consumer today than it was in the analog era and is not recognized by the current predictive model at all. The reason, of course, is that in multipath interference cases the signal is strong. In a sense, in fact, the signal falls victim to its own strength. In geometrically complex environments, it bounces off of buildings and similar surfaces, its reflections encounter its original path from a variety of angles, and thus it ends up interfering with itself. In the analog era, the result was a "ghosted" picture, but a picture of some sort nevertheless. In digital television, the result may be no picture at all. Multipath interference, then, means that the household is predicted as served, precisely on account of the signal's strength, even as the consumer is not able to get any reception whatsoever.

This is not an acceptable state of affairs. To begin to resolve it, Mr. Kurby recommends a reasonable, and indeed conservative, 3dB correction factor based on the work done by H&E in

[53] 47 U.S.C. § 342(e)(2)(A)(i)

[54] *Notice* ¶ 15.

2006.[55] This correction is necessary, but not sufficient to use with all cases of catastrophic interference. More definitive resolution of the problem is undeniably difficult, but eminently possible. The Commission has wisely proposed to keep the proceeding open for the purpose of making precisely such improvements when the data and the research warrant them.[56] But some guidance now is necessary. DIRECTV and DISH request that the Commission acknowledge the need for this adjustment and enunciate guiding principles for its formulation.[57]

Essentially, due to a number of precise mapping tools, it is possible to define the geometrical complexity of the immediate environment of any U.S. household. The degree of propagation path complexity and clutter can then be translated to the equivalent of a loss of strength and incorporated into the model.

IV. STATUTORY CHANGES COMPEL DIPOLE ON-LOCATION TESTING, WHICH IS CONSISTENT WITH THE COMMISSION'S ANALOG MEASUREMENT RULES

A. Congressional Intent Was to Facilitate Indoor Dipole Testing

As with the predictive model, the Commission acknowledges on a theoretical level that the deletion of the "outdoor" antenna requirement has implications for the measurement method, too. Indeed, it lists which "antenna to use in performing on-location testing" as one of three issues raised by STELA's passage.[58] But here again, the *Notice* stops short of recommending changes, except at the margin, citing practical concerns and, again, its belief that Congress

[55] Kurby Report at 5.

[56] *Notice* ¶¶ 31-32 (seeking comment on continued refinement to the predictive model).

[57] Kurby Report at 5.

[58] *Id.* ¶ 34.

codified "the signal intensity standard in Section 73.622(e)(1)."[59] For the reasons discussed above, there is no question that Congress intended to permit indoor testing.

B. Commission Precedent and Consumer Choice Justifies Allowing Indoor Half-wave Dipole Antennas

The Commission properly allowed the use of half-wave dipoles for testing of analog broadcast signals. In its 1999 *Order*, the Commission praised the half-wave dipole as "widely available, inexpensive, and simple to use."[60] While the Commission noted that use of the half-wave dipole was not without its problems, it was by far the superior choice – particularly given cost concerns associated with testing.[61] Further, any drawbacks could be overcome through cluster testing – conducting five tests within several feet of each other.[62] Use of the dipole was even accepted by the broadcasters as a condition to their settlement with Primestar.[63] Seven years later, the Commission proposed reauthorizing the standard half-wave dipole for use in testing in this very proceeding.[64]

In the 1999 *Order*, the Commission recognized the need to accommodate consumer choice and circumstances in yet other ways, and it did so even though the words "outdoor" and "rooftop" were still in the statute. The testing height was made to conform to circumstances that fit "most households in the country."[65] Testing in multiple dwelling units "present[ed] special problems" and so required a special solution: testing at the unit's master antenna, if available, or

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[59] *Id.* ¶ 37.

[60] *SHVA Report and Order*, 14 FCC Rcd. at 2678 ¶ 51.

[61] *Id.*

[62] *Id.* at 2679 ¶ 53.

[63] *Id.* at 2678 ¶ 52 n.139.

[64] Measurement Standards for Digital Television Signals Pursuant to the Satellite Home Viewer Extension and Reauthorization Act of 2004, *Notice of Proposed Rulemaking*, 21 FCC Rcd. 4735 (2006).

[65] *SHVA Report and Order*, 14 FCC Rcd. at 2680 ¶ 58.

otherwise "where the consumer might place a conventional antenna."[66] And, in some instances, the Commission suggested that "the measurement should be taken inside, near the television."[67]

Thus, the Commission permitted use of a dipole and, in certain cases, recognized the appropriateness of inside testing, despite the statutory requirement of an outdoor rooftop antenna, and even though outdoor antennas were not as unusual a part of the American landscape as they have become today. The Commission should follow the lead of Congress, which was led in turn by consumers' choices, and take these choices into account.

C. The Commission Should Establish a Protocol for Indoor Testing

In the *Notice*, however, the Commission proposes to limit the testing protocol to outdoor antennas.[68] Instead, the Commission should establish a protocol for indoor antenna testing. Mr. Kurby recommends such a protocol in his report. The rules recommended by Mr. Kurby would resolve the difficulties cited by the Commission in connection with testing in constrained indoor spaces.[69] In particular, the Commission lists a series of practical issues with indoor testing, including "the performance expected of an indoor antenna, the placement of the antenna, and the location within a structure or room where the antenna is located."[70] Mr. Kurby's report demonstrates that none of these difficulties is insuperable.

Thus, for the Commission's concern that an indoor environment creates a large number of variables, including antenna placement, Mr. Kurby recommends procedures that include orienting the measurement antenna in the direction of the first transmitting station to be

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[66] *Id.* at 2681.

[67] *Id.*

[68] *Notice* ¶ 36.

[69] Kurby Report at 6-9.

[70] *Notice* ¶ 36.

measured, and recording the field strength for that station, as described in Section 73.686(d)(2)(iv) of the Commission's Rules.[71] The optimum horizontal antenna direction would be with the spines perpendicular to the direction of the station and horizontal to the ground.[72] While this antenna orientation is maintained, the field strength would be recorded for the other stations to be measured.[73] This procedure can be a streamlined version of the present rule.[74] The current cluster measurement of five points of measurement is needlessly involved. The locations should be in an area encompassed by a square, circle, or semicircle as possible with 3 meter separation and with one measurement in the center representing the nominal television receive location.[75] The mean value is determined as the average of these linear (non-dB) values.[76] This is then converted to dBu and corrected by the factor to convert median to the 90% or 99% time level.[77]

The Commission provides curves for the (50, 50) and (50, 10) scenarios. These should be adjusted for 99% time variability to account for signal fading that cannot be compensated for by the receiver.[78] In mobile systems the 50% to 90% adjustment is achieved by forward error correction and repeats, neither of these is available for a stationary TV.[79] The Commission

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[71] Kurby Report at 6.

[72] *Id.*

[73] *Id.*

[74] *Id.*

[75] *Id.*

[76] *Id.*

[77] *Id.*

[78] *Id.* at 7-8.

[79] *Id.* at 8.

should either develop curves allowing for this conversion or use a standard method such as Rayleigh, which specifies an increase in necessary power for 50% to 99% of ~17dB.[80]

Use of dipole antennas available commercially and meeting certain standards similar to a 2dBi theoretical antenna, would remove the uncertainty of arbitrary antennas. Antenna gain could be accounted for and factored out using standard industry practice. Antenna height would become irrelevant since the signal level versus height is linear with distance in dB above the ground level according to COST231.[81] So even placing an antenna at table height would be fine compared to any other height in a room.

At a minimum, this indoor strength test should be allowed for consumers who do not actually have an outdoor antenna, as observed by the tester and confirmed by Google Earth. Again, the question of whether a consumer "can" or "is able to" have an outdoor antenna is not the proper standard for the reasons discussed in connection with the predictive model above.

D. No Reception Means that the Household Is Unserved

The *Notice* indicates that the purpose of on-location testing is "to determine definitively whether a local station can be *received* at [the consumer's] location."[82] This is true, and it has an important implication. The Commission should also permit a "reception" test – testing, that is, whether the household can lock on to a viewable signal, no matter how strong it is. It is true that, at first blush, the statute appears to contemplate a strength test. It is moreover true that this is the manner in which the statute has traditionally been construed. Closer review, however, casts doubt on that reading.

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[80] *Id.*

[81] Kurby Report at 6.

[82] *Notice* ¶ 33 (emphasis added).

For a household to be served, not only does the signal need to be of sufficient strength, the household must be able to "receive" the signal in the first place. "Receive," then, can be read to denote a separate element of the standard, and an antecedent element at that. Under this reading, a household would first and foremost need to receive a viewable signal to count as served. Only if it receives such a signal in the first place does the strength of the signal become relevant.

This reading is bolstered by the lay person's understanding of "receive." A consumer would be hard pressed to agree that she "receives" a signal if, in the digital world, he can not watch it. This reading is also buttressed by the policy underlying the unserved household standard in the first place. Congress wanted people who could not watch their local network programming over the air to be able to receive a distant station affiliated with the same network. To create a fiction that a consumer receives the local programming if he can see nothing on his screen disserves that objective. That fiction may have been inevitable in the analog world, when the question of whether reception is adequate was necessarily fraught with subjectivity. It is both avoidable and no longer tenable after the digital transition in the world of zeroes and ones. Today, a household either gets a picture over the air, or it does not. Mr. Kurby describes a simple test for whether a household can receive a viewable signal in the first place, which is to simply test reception.[83]

[83] Kurby Report at 9.

V. CONCLUSION

In prescribing a predictive model and measurement method to determine if a household is unserved in the digital era, the Commission should give effect to the changes made in STELA and recognize the reality of consumer choices and circumstances.

Respectfully submitted,

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August 24, 2010

Engineering Analysis and Statement of Christopher Kurby, MEM, MEE, BSEE

FCC's Proposed Rules for the Establishment of a Model for Predicting Digital Broadcast Television Field Strength Received at Individual Locations and Measurement Standards for Digital Television Signals Pursuant to the Satellite Home Viewer Extension and Reauthorization Act of 2004

FCC 10-133, ET Docket Nos. 10-152 and 06-94

Prepared by

August 24, 2010

Engineering Analysis and Statement of Christopher Kurby, MEM, MEE, BSEE

I have been retained by DIRECTV, Inc. and DISH Network L.L.C. to provide expert technical analysis of the issues raised in the *Notice* released by the FCC on July 28, 2010, FCC 10-133, in ET Docket Nos. 10-152 and 06-94. My curriculum vitae is attached.

I. Predictive Model

A. Antennas for prediction

The antenna specifications for the predictive model should be revised to reflect typical antenna gains as pointed out by the study submitted by the engineering firm of Hammett & Edison ("H&E") in the record of this proceeding on August 7, 2006, and also suggested by the Institute for Telecommunications Sciences ("ITS") in the report. The FCC outdoor planning factors for low VHF,VHF,UHF are 4, 6, 10 dBd respectively, whereas the ITS values for low VHF,VHF, and UHF are -4.4, -2.8, -3.0 dBd respectively. The difference represents about a 9dB loss from external antenna gains; thus signal levels for indoors should be reduced for antenna gain by 9dB from the outdoor predictions using the outdoor planning values.

B. TV antenna height

The present FCC rules use a rather excessive and unrealistic antenna height for calculation of signal power. Data taken by Okumura and by COST231[1] provide correction factors for a change in mobile antenna height, applied here as TV antenna height. That factor can be directly used to determine the scale factor from the reference antenna height used by the ILLR model to the desired height as:

- K=10Log10(hact(m)/6) dB for 150MHz to 1000MHz.
- Using 1m as the typical indoor height the value is 7.7dB.

We believe that an antenna height representing a first floor TV receiver should be used. That height should specifically be set at 1m. Using the same value for frequencies < 150MHz will introduce some error. The FCC should seek comment on the proper factor for frequencies < 150MHz.

C. Correction for 99%

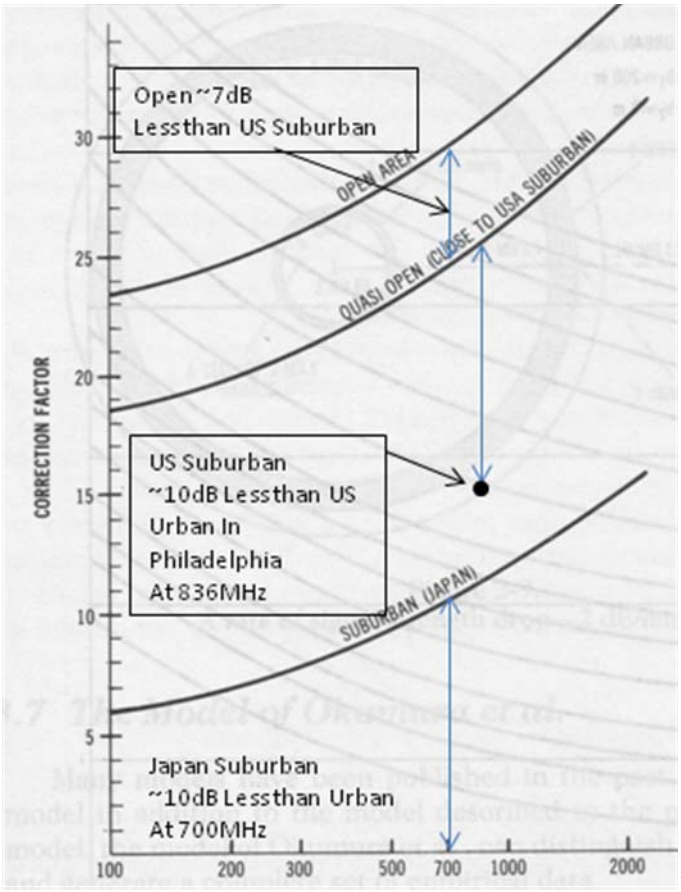
The FCC provides curves for the (50, 50) and (50, 10) (% location, % time) scenarios. The FCC should define values for 99% time availability. These should be adjusted to account for signal fading that cannot be compensated for by the receiver. In mobile systems, the 50% to 90% time availability factor is accounted for by forward error correction and repeats, neither of which is available for a stationary TV. The FCC should either develop curves allowing for this conversion or use a standard method such as Rayleigh, which describes an increase in necessary power for 50% to 99% of ~17dB[2]. Notably, H&E found that 4.7dB and 17.5dB respectively

would need to be added to the high VHF and UHF signal strength standards to increase to the 99% probability level, which approaches Rayleigh values at higher frequencies.

The ILLR model suggests use of the 90% time values, thus the correction factor for the ILLR model is only 10dB instead of the 17dB needed for adequate reception.

D. Clutter

The present factors used in the ILLR computer model are almost all 0dB with a few exceptions. The FCC should adopt values similar to those determined by Okumura and mentioned by A. G. Longley. Okumura provides graphs that describe the relationship of clutter loss adjustment factors to calculations for urban, suburban, quasi open, and open areas. These are approximately 6dB to 10dB less for suburban areas and 24dB to 30dB less than Tokyo urban areas. There likely are better data available now more representative of U.S. cities than Tokyo when these data were collected. U.S. urban signal loss is ~10dB more than the loss typical in U.S. suburban environments and is commonly used. The correction factor in U.S.[4] coverage calculations could be as much as 23dB, as can be seen from the figure below[5].



The FCC ILLR computer program seems to calculate signal levels for rural areas and applies clutter correction to the measured values. Thus, the values in the chart above are used in a reverse direction to reflect the proper environment. For example, to correct Open to US Suburban at 700MHz (30-34), 6dB must be added to the signal loss. The ILLR model uses 5dB for channels 14-36 and 7 dB for channels 38-69, so the suburban environment may be adequately quantified but the additional losses inevitable in urban environments seem to be lacking.

E. Building penetration loss

Building penetration loss is dependent on many factors including the question of whether the building is in the direct line of sight ("LOS") of the transmitter or non-LOS as in the clutter factors used here. Many cellular and land mobile coverage calculations are computed with fixed factors depending on frequency. The COST231 model accounts for many factors and is useful for 150MHz to 2000MHz.

The typical value used for cellular at 800MHz is 20dB[3] for 90% confidence and increases with increasing frequency. The FCC should seek further guidance on determining this value.

Mean values for VHF and UHF building penetration losses are given by Rice are given in the paper[7] at 24dB at 35MHz and 22dB at 450MHz with high sigmas. This is supported by data from iBlast with data at some West coast cities[8] which reports 18.5dB to 21.5dB for UHF. Adding a factor of 1.3 sigma to obtain 90% confidence make these even higher.

F. Adjustments

- H&E suggests that the Rx noise figure can be degraded by 3dB due to antenna mismatch.
- Low cost set top box receivers are known to have 11.3dB worse sensitivity as reported by H&E, and this should be accounted for.
- TV receiver channel equalizers also degrade the Signal-to-Noise ("SNR") by 3dB as they attempt to mitigate for multipath, as correctly indicated by H&E. This will always be the case as equalizers come at a penalty. This should be accounted for.
- For building penetration loss another factor of about 20dB for ~700MHz should be added for 90% confidence. If the confidence is set at 50%, a factor of about 10dB for ~700MHz would need to be added.

The total adjustment factors for 700MHz for the ILLR model should be:

Sin_build=Soutdoors +Ant_out_in + Ant_ht_out_in + Clutter_factor + Build_loss +NF_typ_calc + NF_mismatch + Equalizer_deg + 90%_to_99%.

The total correction for 700MHz for the ILLR model should be:

K= Ant_out_in + Ant_ht_out_in + Clutter_factor + Build_loss +NF_typ_calc + NF_mismatch + Equalizer_deg + 90%_to_99%.

K=-9 -7.7 -0 -20 -11.3 -3 -3 -10 dB

= 64dB

G. Co-channel interference

The FCC sets up co-channel interference criteria[6] for various interference scenarios of DTV and analog. These criteria apply equally well to indoor antennas and outdoor antennas for practical purposes. This is because we assume that both the desired and undesired station are attenuated equally by a single attenuation value. This is a conservative assumption, as it will not always be the case and a station predicted to be operational in-doors may fail due to excessive co-channel interference. The change in ratio of desired to undesired or delta in dB is directly related to the difference in sensitivity of the analog and DTV receivers. In the best case if we assume the DTV or analog TV signal is white Gaussian noise, then the ratio is exactly the same as the change in sensitivity. But this can be much worse if there is any correlation which is likely.

H. Multipath interference

The prediction of multipath interference is a complex exercise as it depends on precise geometry and electromagnetic modeling. However, we do know from the H&E report that present equalizers used to compensate for some moderate multipath while correcting the multipath will degrade the receiver sensitivity by 3dB or even 4dB. So it is reasonable to add a 3dB correction factor to account for this case in all predictions to either degrade the receiver sensitivity or the DTV power at the DTV receiver. Even this adjustment, however, will not accurately predict some cases of catastrophic multipath interference. In addition, therefore, the Commission should invite a further study aimed at assigning specified signal loss equivalent values for an area's surface complexity. Essentially, due to a number of precise mapping tools, it is possible to define the geometrical complexity of the immediate environment of any U.S. household. The degree of propagation path complexity and clutter can then be translated to the equivalent of a loss of strength and incorporated into the model.

II. Measurements

A. Antennas for testing

The FCC should allow the use of dipole antennas with gains consistent with the values herein. Using this type of antenna allows us to account for a real (and lower) antenna gain using the values as included in the H&E report and characterized by the Institute for Telecommunications Sciences for low VHF, VHF, and UHF of -4.4, -2.8, -3.0 dBd. Since the measurement antenna is very close to an ideal 0dBd (2dBi) antenna the correction factors are simply: -4.4, -2.8, -3.0 dBd respectively.

B. Location selection

The location for measurement should be the room the TV is intended to be used in.

Antenna height above the floor is almost completely irrelevant since the signal level versus height is linear with distance in dB above the ground level according to COST231. Thus 10 feet versus 13 feet is only 1dB. So simply using table height (or any other height) will not affect the analysis substantially.

The five locations should be in an area encompassed by a square, circle, or semicircle as possible with a minimum 3 meter separation between measurements and with one measurement in the center representing the nominal television receive location.

C. Procedure

I recommend using a slightly modified version of the procedures recommended by H&E in 2006:

1. Orient the measurement antenna in the direction of the first transmitting station to be measured, and record the field strength for that station, as described in Section 73.686(d)(2)(iv).

The optimum horizontal antenna direction is with the spines perpendicular to the direction of the station and horizontal to the ground.

2. While maintaining this antenna orientation, record the field strength for the other stations to be measured.

This procedure can be a streamlined version of the present rule. The mean value is determined as the average of these linear (non-dB) values. This is then converted to dBu to generate the mean value in dBu.

D. Adjustments

- H&E suggests that the Rx noise figure can be degraded by 3dB due to antenna mismatch.
- Low cost set-top box receivers are known to have 11.3dB worse sensitivity as reported by H&E and this should be accounted for.

- TV receiver channel equalizers also degrade the SNR by 3dB as they attempt to mitigate for multipath as indicated by H&E. This will always be the case as equalizers come at a penalty. This should be accounted for.
- The noise floor of the test receiver should be measured and the measured value of the signal corrected if it is <10dB above the noise floor. This is also suggested by H&E but they used a 3dB criteria which is not as accurate as the factor used here.
- The total adjustment factors for measured values (assuming the 10dB above noise floor correction is already made) are:

  Sin_corrected=Smeas +Ant_Cal_in +NF_typ_calc + NF_mismatch + Equalizer_deg + mean_to_99%.

  Sin_corrected=Smeas + select(-4.4, -2.8, -3.0) –11.3 -3 -3 -20 dB.

  Sin_corrected=Smeas + select(-4.4, -2.8, -3.0) -37.3 dB.

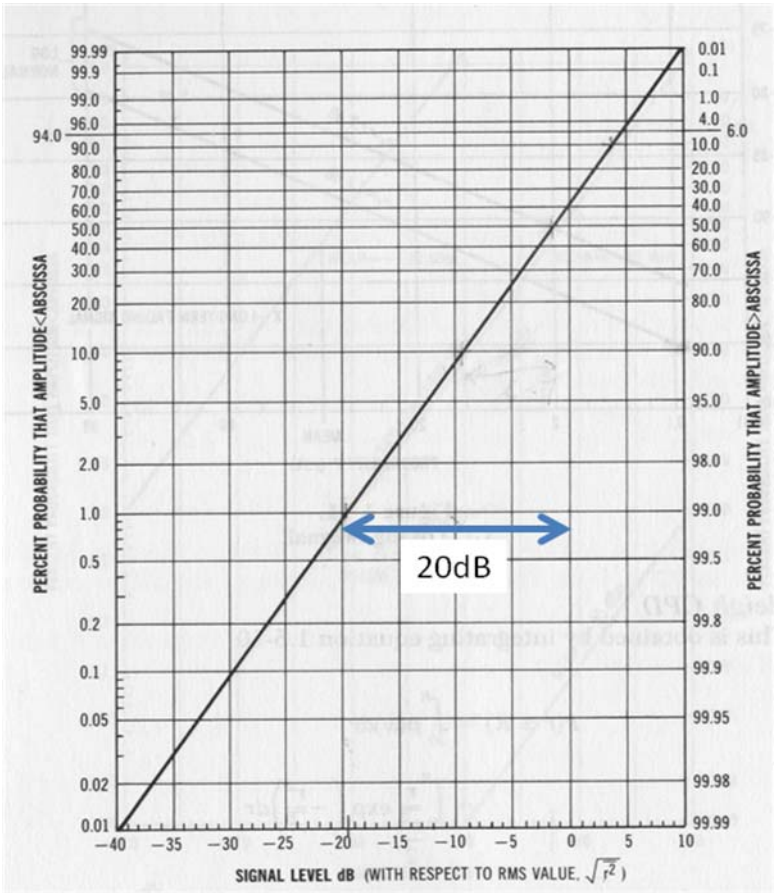
The corrected value from the measured value will be at least 37.3dB worse than measured by the calibrated antenna.

E. Measurement safeguards

Requiring the agent that measures the area for TV reception to submit a report that describes the building, the rooms in general, the room measured, the locations measured, the measured and calculated results, and equipment used would provide a sufficient recordkeeping and audit device to help ensure and measure the integrity of the measurement standards. This will allow for appropriate review of the material to check for location and measurement integrity.

F. Correction for 99%

The value calculated above results in an estimate of the local mean and represents 50% time variability. The time availability is attributed to local fading caused by nearby reflections, even those outside the building. As mentioned above, in mobile systems the time variability is accounted for by forward error correction and repeats, neither of these is available for a stationary TV. The FCC should either develop a conversion factor or use a standard method such as Rayleigh, which describes an increase in necessary power from the mean to 99% of 20dB. (Note that this is 3dB more than the 50% value as seen below.)



G. Multipath

The effect of multi-path interference is to deteriorate the signal to the extent it is undecodable even at high signal levels. Thus, there is always the possibility that multipath will be severe enough to catastrophically affect the channel even with aiming of directional antennas. If this happens then the consumer should be allowed to demonstrate this and be allowed to access distant signals from satellite TV.

The simplest test is to test reception. If the television receiver in a household cannot lock on to a viewable signal, it is either because of low strength or because of uncompensatable multipath interference. The key safeguard for such a test is for the tester to ensure the TV receiver meets sensitivity specifications.

REFERENCES

[1] "DIGITAL MOBILE RADIO TOWARDS FUTURE GENERATION SYSTEMS COST 231 Final Report," Chapter 4.

[2] Jakes, W.C., *Microwave Mobile Communications*, John Wiley and Sons, New York, 1974, page 315.

[3] "Aspects of HSUPA Network Planning," 80-W1159-1 Rev B, Qualcomm, 5775 Morehouse Drive San Diego, CA 92121-1714, Engineering Service Group, page 19.

[4] Jakes, page 105.

[5] Lee, W.C.Y, *Mobile Communications Design Fundamentals*, (Indianapolis, Howard W. Sams & Co.) 1986, page 74.

[6] http://www.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet69/oet69.pdf, table 5A.

[7] Mejuto, Noelia Vazquez, Penetration and Transmission of UHF Radio Waves into/through Buildings – A Literature Review, Eindhoven University of Technology, Faculty of Electrical Engineering, Telecommunications, Technology and Electromagnetics Group, 1999 page 7, http://alexandria.tue.nl/extra1/afstversl/E/560768.pdf.

[8] Miller.A, et.al., iBLAST DATA BROADCASTING FIELD TESTS, 23 April, 2001, page 9, www.iblast.com/new/downloads/iBlastFieldTestWhitePaper.pdf.

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 August 24, 2010.

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SUMMARY

An accomplished, innovative professional with extensive experience in RF and digital base-band IC system design, radio link margins, digital communications and radio electromagnetic compatibility. Recognized for radio architectural knowledge having brought several satellite and 3G IC handset platforms to market with several IC manufactures. Expert in propagation and coverage and spectrum compatibility with successful regulatory and standards development collaborating with many outside agencies including, commercial, consumer and governmental.

PROFESSIONAL EXPERIENCE

Eclipse design Technologies Inc **2009 to present**
Chief of RF Engineering
www.eclipsedt.com

- Responsible for RF IC architecture

Quantum Dimension Inc. **2007 TO FEB 2010**
VP of Engineering
www.qdimension.com

- Responsible for architecture solutions targeted at DoD and commercial entities.
- At least 50% responsible for technical completion of SBIR Phase 1 contract and in successful acquisition of the SBIR phase II for the Air Force on Navigation using Signals of Opportunity and the granting of another SBIR phase 1 contract with the Navy for High Efficiency WCDMA Power Amplifier for MUOS Handheld Radio
- Patent subject matter expert for outside companies

CONSULTING (WIRELESS CONSULTANTS LLC DISOLVED)
SOLE PROPRIETER **2009 TO PRESENT**

- Services provided on Patent portfolio development and strategy.
- Services provided helping to shape the technology of new companies for acceptance by mobile phone manufactures and operators.
- Assist in technology development including RF and RF IC architecture and system modeling
- Patent subject matter expert for outside companies

WIRELESS CONSULTANTS LLC **2007 TO 2009**

www.wirelessconsultants.net

Christopher Neil Kurby

President of company helping to shape the technology of new companies for acceptance by mobile phone manufactures and operators. Assist in technology development.

Quantance Inc. **2007 TO PRESENT**
Engaged as consultant
www.quantance.com

- Technical Advisory board member of Quantance Inc.
- Generated HSUPA link margin with new technology and compared to present methods.
- Generated current drain savings with shadowing profiles both available and synthesized from log normal statistics.
- Generated multiple ideas to assist Quantance in RFIC product development.
- Used extensive connections to bring them to consideration by major handset vendors.
- Enhanced patent portfolio

Caerus Institute of Open Innovation **2009 TO PRESENT**
www.caerusinstitute.com
Senior Innovator
Part time associate

MOTOROLA INC., Schaumburg, Illinois **1973 to 2007**
A world leader in radio communications systems and devices serving the private land mobile governmental and consumer communities.

Fellow of the Technical Staff and Director of 3G IC engineering
Mobile Devices Business (MDb)- Technology Office (1992-2007)

Reported to the Vice President of Advanced multi-mode handset platforms in MDb. Led a small highly skilled and focused technical team of RF and digital baseband engineers in the design of advanced Tx and Rx architectures for 3rd generation cellular handset Integrated circuits.

- Established IC roadmaps for future generations of 3G IC's working with technical and marketing experts within MDb and outside continuing to drive down size and cost with each generation while adding features. This was used to shape vendor IC plans and internal development plans for MDb.
- Created and facilitated technical presentations for operators including DoCoMo, Cingular, Sprint, Nextel, Verizon and others which aided in their technology execution decisions.
- Jointly defined, with Freescale. Texas Instruments, Maxim, SIRF and other IC manufacturers, architectures for 3G WCDMA RF and baseband IC's to support HSDPA and HSUPA under the roadmap,
- Provided Cellular Operators, ETSI and the FCC technical groups guidance which defined emissions and operating rules for the PCS G and H block, the ITU 3G expansion bands and the US AWS bands.
- Evaluated RF and baseband technologies from many start-up and other technical sources for possible inclusion into Motorola handsets and IC's.
- Chairman of the Motorola Multi-mode Multi-band patent committee 2006-2007 which selected disclosures for filing.
- Co-Chairman of the Motorola Radio Architecture steering committee on combined transceiver architectures ~2005-2007 which provided direction to the corporation on handset architectures.

Sr. Member of the Technical staff –Satellite Subscriber Products (1989-1992)

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Reported to the VP of satellite handset engineering and led the technical design of Iridium Satellite cellular handset for 3 generations of handsets from the start until project termination.

- First in Motorola to measure in-building penetration by satellite and determined the calibration procedure for fly by Iridium propagation testing executed by Dr. Wolf Vogel of University of Texas
- Primary inventor of paging system method using voice compatible modulation adopted by Iridium for paging, patents issued
- Developed architecture and defined transceiver IC for Iridium handsets
- Developed antenna noise calculation method for quasi-hemispherical antenna for handset and developed link margins for subscriber communication links for Iridium.
- Developed mathematical models and computer model to simulate and estimate adjacent channel rejection using fading data, used to establish requirements and design.
- Presentations to technical standards bodies including the ITU and ETSI and regulatory agencies including ERC, FCC and Japanese MPT and others around the world to establish standards and regulations for mobile satellite handsets.

Member of the Technical Staff Secure Communications –Land Mobile Product Sector (1986-1989)
Focused on the design of Secure Simulcast systems.

- Developed mathematical foundation for simulcast coverage assuming various propagation models, log-normal fading, non homogenous terrain and Raleigh fading.
- Developed computer program to estimate coverage using mathematical model, transferred to field teams.
- Designed first 12Kbps GFSK simulcast systems.
- Defined 4 Level GFSK modulation method for enhanced simulcast performance.

Senior Staff Engineer Land Mobile Base Station Engineering (1973-1986)
Designer of selected Circuit and Rx and Tx system blocks for 450 and 800 MHz base stations.

EDUCATION

MEM, Master of Engineering Management, Northwestern University ,Evanston Illinois,1984

MEE, Master of Electrical Engineering, Midwest College of Engineering (Merged with Illinois Institute of Technology in 1986) 1977

BSEE University of Illinois Champaign Urbana Illinois, 1973
Graduated with Honors

Continuing education 5 graduate classes in advanced communications at IIT after MEE

PROFESSIONAL DEVELOPMENT

Five E.E. graduate level courses in communications beyond Masters level from IIT.
Many technical seminars.

PROFESSIONAL AFFILIATIONS

Member of I.E.E.E. since 1988

Christopher Neil Kurby

CERTIFICATIONS

Former Illinois registered professional Engineer 1980. (License lapsed due to minimum professional utility, could be reinstated)

TECHNICAL SKILLS

- Expert in:
  - Terrestrial and satellite link margins for mobile handsets
  - RF handset systems and radio architectures
  - Baseband system design and radio architectures
  - RF and IC system design
  - RF inter system compatibility, called upon by industry experts for advise
  - RF interference and compatibility
  - Regulatory affairs
  - Navigation systems
- Skilled in digital communication systems
- Experienced in system modeling in MATLAB

Christopher Neil Kurby

ADDENDUM

PATENTS Summary

31 US Utility Patents granted in radio communications
1 European Patent granted
8 more filed and pending.
1 filed in 2010

PATENTS

Easily found at USPTO.gov http://patft.uspto.gov/netahtml/PTO/search-bool.html

PAT. NO.Title
1 7,197,291 TMultimode receiver and method for controlling signal interference
2 6,993,296 TMultimode background scans of different communication systems on similar frequencies
3 6,944,427 TReduced crossmodulation operation of a multimode communication device
4 6,476,776 TSatellite adaptive antenna system
5 6,351,653 TCellular telephone with simultaneous radio and cellular communications
6 6,323,804 TMethod and apparatus for GPS time determination
7 6,252,455 TMethod and apparatus for efficient signal amplification

8 5,999,125 TMethod and apparatus for a global positioning data service
9 5,963,846 TMethod and system for repeating pages
10 5,930,679 TSatellite-based ring alert apparatus and method of use
11 5,930,268 TTransceiver and associated method for surviving fades
12 5,889,492 TMethod and apparatus for an acquisition-aided Geo-locating subscriber unit
13 5,808,585 TMethod of configuring multiple-arm antenna element in a radome
14 5,761,608 TMethod and apparatus for inter-node handoff of a radio frequency communication unit
15 5,737,685 TCo-located subscriber unit to subscriber unit communication within a satellite communication system
16 5,613,194 TSatellite-based cellular messaging system and method of operation thereof
17 5,606,332 TDual function antenna structure and a portable radio having same
18 5,603,079 TSatellite-based messaging system transmitting during guard band of satellite-based telephone system and method of operation thereof
19 5,600,341 TDual function antenna structure and a portable radio having same
20 5,596,315 TMessage unit for use with multi-beam satellite-based messaging system and method of operation thereof
21 5,574,968 TSatellite cellular communication methods for performing cell-to-cell handoff
22 5,559,806 TTransceiver having steerable antenna and associated method
23 5,548,800 TSatellite telecommunication system with apparatus for protecting radio astronomy and method of using same
24 5,521,941 TAutomatic threshold control for multi-level signals
25 5,396,643 TGeographic-area selective low-earth satellite-based paging broadcast system and method
26 5,347,542 TDemodulation selection for a communication signal
27 5,239,672 TSynchronization method and apparatus for simulcast transmission system
28 4,608,699 TSimulcast transmission system
29 4,491,806 TResonant cavity with integrated microphonic suppression means

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30 4,481,489 TBinary signal modulating circuitry for frequency modulated transmitters
31 4,449,250 TRadio-frequency synthesizer for duplex radios

EP 1 058 378 B1 Multiplier for multiplying complex signals

Publications and pending patents

PUB. APP. NO.	Title
1 20070047625	Multi-mode wireless communication device and method
2 20060227852	METHOD AND APPARATUS FOR REDUCING DATA COLLISIONS IN A FREQUENCY HOPPING COMMUNICATION SYSTEM
3 20060068831	Predictive power control in a digital diversity receiver
4 20060045087	Method and apparatus for sending IP multicast packets in a wireless communication system
5 20050141596	Method and apparatus for reducing data collisions in a frequency hopping communication system
6 20050075077	Multimode receiver and method for controlling signal interference
7 20040176039	Multimode background scans of different communication systems on similar frequencies
8 20040152429	Reduced crossmodulation operation of a multimode communication device

PRESENTATIONS and PUBLICATIONS

C. Kurby , 1992 *Motorola's IRIDIUM system: low-Earth orbit global cellular communications network* . Presented at IEEE Antennas and Propagation Society International Symposium,1992, Chicago Illinois. (Actually material developed and presented by Christopher Kurby in lieu of Dr. Ray Leopold) Pages: 1270 vol.3 Digital Object Identifier: 10.1109/APS.1992.221772

G.C. Hess, “Land-Mobile Radio System Engineering” ,Artech House Publishers 1993
Kurby Cited in book for technology referenced

C. Kurby , 1993 *Presentation on Iridium system and handset* UIUC Annual March conference 1993

C. Kurby , 1994 *Presentation on Iridium system and handset* IIT invited speaker technical seminar 1994

C. Kurby , 1994 *Presentation on Iridium Global Personal Communication System,* Second Wireless/PCS Communications Symposium,IEEE Communications Society,Chicago Chapter, University of Illinois at Chicago October 1994

C. Kurby , 2000 *Paper on Emission capability of handset transmitters*. Electro Magnetic Compatibility, EMC2000. Wroclaw, Poland, 27-30 June 2000. http://www.emc.wroc.pl.

C. Kurby , 2001 *Migrating TDMA networks to WCDMA, Subscriber Terminal Implications and other RF Technical Challenges*: UWCC UWCC Global Summit 2001

C. Kurby , 2005 Panel Participant on power issues and management, International Wireless Industry Consortium (IWPC), 2005

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C. Kurby , M. Enright ," A Signals of Opportunity Based Cooperative Navigation Network", *National Aerospace & Electronics Conference 2009*

AWARDS and recognitions

- Selected to Motorola SABA (Science Advisory Board as Associate member)- considered as top 4% of Motorola Engineers ~1986
- Served as technical reviewer for the IEEE VTC conference 1995
- Motorola Master Innovator 2001
- Elected as Motorola Dan Nobel Fellow - considered as top 1% of Motorola Engineers 2001
- Numerous Motorola standard awards in ETSI satellite standards, 3G ETSI standards
- Chairman of the Motorola Multi-mode Multi band patent committee 2006-2007
- Co-Chairman of the Motorola Radio Architecture steering committee on receivers ~1998-2005
- Co-Chairman of the Motorola Radio Architecture steering committee on combined transceiver architectures ~2005-2007
- Motorola Global standard Impact Award 1996 (two instances)
- Motorola Global standard Impact Award 1997
- Motorola Global standard Outstanding Performance 2005
- Participated in several technical promotion committees in Motorola
- Member of the Mobile devices patent committee from ~1990 to 2007