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

In the Matter of	)	
	)	
Technical Standards for Determining	)	ET Docket No. 05-182
Eligibility for Satellite-Delivered Network Signals	)	
Pursuant to the Satellite Home Viewer	)	
Extension and Reauthorization Act of 2004	)	

COMMENTS OF THE ABC, CBS, AND NBC TELEVISION AFFILIATE ASSOCIATIONS

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Summary

SHVERA requires the Commission to report to Congress on a variety of factors that may ultimately affect whether a household is deemed to be "unserved" by a digital television signal as that term is defined in 17 U.S.C. § 119(d)(10). While SHVERA specifies certain particular considerations the Commission is to study, as the *Notice* recognizes, the Commission's inquiry must be predicated upon the fundamental nature of the "unserved household" limitation set forth in the Copyright Act. That fundamental nature is a compulsory license operating in derogation of the property rights of copyright holders which should, accordingly, always be conservatively construed in favor of the local broadcast station.

In its *SHVA Order*, and in keeping with the narrow purpose of the distant signal compulsory license, the Commission properly allowed the principle of localism and several important corollaries to guide its decision to recommend to Congress the Individual Location Longley-Rice ("ILLR") predictive model in the form that it did. *First*, the Commission respected the fact that SHVA reflected "Congress' intent to protect the role of local broadcasters in providing free, over-the-air television to American families." *Second*, the Commission sought to formulate an approach whose effect would neither "increase the number of unserved households that already exist, nor . . . reduce the size of local stations' markets by subtracting viewers who are able to receive their signal." *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." *Fourth*, and finally, the Commission recognized that a "predictive model that includes truly served households in an unserved category, even temporarily, creates . . . undesired effects." These same principles should continue to guide the Commission in the instant proceeding.

The Commission should also be mindful that SHVERA is not merely a continuation of the Section 119 *status quo ante*. Rather, SHVERA, building upon the local-into-local Section 122 compulsory license enacted in SHVIA, begins to *phase out* the Section 119 distant compulsory license. Although the definition of "unserved household" has not been substantively changed, the class of viewers to whom satellite carriers may retransmit distant duplicating network signals has been considerably narrowed through the principle of "if local, no distant." The new, fundamental limitation imposed by SHVERA is the *ineligibility* for distant network signals of satellite subscribers who are able to obtain access to the local network signals of local broadcast stations via local-into-local service offered pursuant to the Section 122 license. This principle applies as fully to digital signals as it does to analog signals.

In fact, the primary category of satellite subscribers for whom site testing is even statutorily authorized (and, hence, for whom this proceeding is even relevant) is narrower still: Where a satellite carrier does not offer local-into-local digital service but does offer local-into-local analog service, if the satellite subscriber is *served* over the air by the local station's analog signal, then such a subscriber *may* be eligible for distant digital service provided a site test measurement, under certain further conditions as to market, date, and DTV build-out status and conducted pursuant to the current test methodology set forth in Section 73.686(d), demonstrates that the household cannot receive a digital signal of signal intensity that exceeds the DTV signal intensity standards set forth in Section 73.622(e)(1).

Accordingly, what is left, then, for the Commission in this proceeding, like the Section 119 license itself, is narrow, requiring a conservative approach to respect the limited nature of the compulsory license and to preserve the integrity of the localism principle. Although SHVERA lists six specific items that the Commission is to study in this proceeding, logically these items may be

reclassified into three separate, but ultimately interrelated, concerns: (1) the appropriateness of the DTV planning factors which resulted in the digital signal intensity standards set forth in Section 73.622(e)(1); (2) the appropriateness of the objective analog signal site test methodology in Section 73.686(d) in the digital signal context; and (3) the advisability of developing a predictive model for future use.

Fundamental to digital television is the Commission's decision to predicate the coverage area of the new DTV service upon each station's existing NTSC Grade B service area. The Commission carefully crafted its approach to "foster the transition to DTV, while simultaneously preserving viewers' access to off-the-air TV service and the ability of stations to reach the audiences they now serve." Maintaining viewer "access to the stations that they can now receive over-the-air" was a critical component of the DTV replication scheme. Thus, the value of over-the-air service to both viewers and broadcasters was fundamental to the Commission's actions. Obviously, the Commission would not have predicated DTV—for which broadcasters have invested many millions of dollars—on planning factors intended to replicate existing television service if those factors were not, in fact, adequate or up to the task.

As the *Notice* correctly states—and critical to the Commission's entire DTV plan to replicate NTSC Grade B service areas—"[*t*]*hese criteria presume that households will exert similar efforts to receive DTV broadcast stations as they have always been expected to exert to receive NTSC analog TV signals*." As the extensive discussion herein of each of these planning factors demonstrates, the Commission's existing noise-limited field strength thresholds for DTV service are more than adequate for real-world reception of local digital broadcast signals.

In fact, the discussion of the adequacy of the DTV planning factors, the specifications and characteristics of currently available consumer equipment, and the Commission's intentions and

expectations in promulgating the DTV planning factors all point ineluctably to the following answers to queries raised in the *Notice*:

- The receiving antenna must be mounted outside on the roof or adjacent to the house. Moreover, the antenna must be oriented to the desired signal, and if the desired stations are not located in the same direction, then the antenna must be orientable in the direction of the desired signal(s). An excellent outdoor antenna receiving system can be installed for approximately $100, including an eight-way bowtie-with-screen antenna and a rotor with remote control.

- The Commission should continue to recommend that the current signal strength thresholds for noise-limited digital service should be used to define the availability of a DTV signal for determining whether a household is eligible to receive distant digital signals from satellite services. Real-world equipment, including fifth generation receivers, demonstrates that the Commission's current signal strength thresholds are more than adequate to receive a high-quality digital picture.

- Variation in DTV set prices should play no role in determining whether a household is unserved by an adequate DTV network signal. The evidence shows that there is very little penetration (no more than 1%) of early generation DTV receivers in television households. Most households have or will acquire DTV sets with integrated tuners incorporating the latest generational chip design (fifth generation or later), including equalizers demonstrating superior multipath handling performance capabilities.

- Multipath should not be taken into account in determining whether a household is served by an adequate digital signal. Fifth generation receivers incorporate equalizers that are remarkably good at handling very early pre-ghosts and very late post-ghosts (on the order of 50 microseconds each). But, more fundamentally, multipath is not a matter of signal strength, which is the objective means by which a digital "unserved household" should be determined. The effects of multipath, however, can be greatly, if not wholly, mitigated by the use of the latest generation receiver; by the use of an outdoor antenna raised to 30 feet which will place the antenna above many of the principal multipath reflectors; and by the use of highly directional antennas with high front-to-back ratios, properly oriented to the strongest desired signal.

Although the Commission's testing procedure for cluster measurements of signal strength at household locations in Section 73.686(d) was developed specifically for analog signals, it is

generally workable for digital signals once several slight modifications are made to measure the signal strength of digital signals: *First*, a directional gain antenna should be utilized instead of a half-wave dipole. *Second*, the field strength of a digital signal should be determined by measuring the integrated average power over the 6 MHz bandwidth. *Third*, the tester should use a spectrum analyzer tuned to the center of the channel, sweep across a variety of small intermediate frequency bandwidths, and integrate the total power across the 6 MHz bandwidth.

With these slight modifications, the testing methodology in Section 73.686(d) will permit the objective testing of the signal strength of digital signals. But this is true only if the remaining elements of the testing methodology are not altered. Most notably, the site test must measure signal strength *outdoors*, at the specified rooftop heights (20 feet for one-story residences, 30 feet for all others), and with the testing antenna properly oriented. Finally, the test methodology must remain objective. There is neither any basis nor any warrant for the Commission to consider altering any aspect of the test methodology that would add any element of subjectivity to the test.

Network Affiliates believe that the Commission should develop and recommend a predictive model for digital signals, but only for future, and not immediate, use. By "future use," Network Affiliates mean *after* the digital transition is *complete.* Before the end of the transition, too much is unknown, the process would be too complicated, and the resulting viewer confusion could be rampant. For example, not all stations have made elections for their final digital channel, and the spectrum repacking process is far from complete. Importantly, digital service for low power stations and translators has not yet been authorized. Because a household is considered "served" if it receives a signal from any station, be it full power, satellite, or translator, affiliated with the network in issue, it is not possible to predict whether a household can receive a digital signal if the station that could be delivering the signal has not yet been authorized to broadcast in digital or the station has not yet

had a reasonable opportunity to construct digital facilities. Waiting for the completion of the digital transition will not materially prejudice the distant signal license, especially when weighed against the countervailing harms to local affiliates if a predictive model is implemented prematurely.

It would be appropriate for the Commission to recommend the ILLR model for digital signal prediction purposes at the end of the DTV transition—with one exception. The ILLR model as currently structured in OET 72 *over-provides* for clutter at UHF frequencies, and, in the digital context, these UHF clutter loss values make the model less accurate, rather than more accurate. In the case of digital signal predictions, the clutter considerations already inherent in the basic, semi-empirical Longley-Rice model provide a more accurate predictive model than the additional UHF clutter loss values added into the ILLR model in OET 72. The National Association of Broadcasters ("NAB") is providing extensive data (more than 2000 individual site predictions with associated measured field strengths) in its comments in this proceeding providing empirical support for this slight modification to the ILLR model.

For the reasons contained herein, Network Affiliates respectfully request that the Commission recommend to Congress (1) that the digital signal strength thresholds set forth in Section 73.622(e)(1) remain the same for purposes of determining whether a household is "unserved" by a digital signal pursuant to 17 U.S.C. § 119(d)(10); (2) that the testing methodology set forth in Section 73.686(d) be modified slightly so that the procedure may be correctly used for digital signal site tests; and (3) that Congress prescribe a slightly modified ILLR model (without UHF clutter loss values) to be used after the digital television transition is complete to presumptively determine the eligibility of a household to receive a duplicating distant digital network signal.

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TELEVISION AFFILIATE ASSOCIATIONS

The ABC Television Affiliates Association, the CBS Television Network Affiliates Association, and the NBC Television Affiliates Association (collectively, the "Network Affiliates"), by their attorneys, hereby comment upon the *Notice of Inquiry* ("*Notice*"), FCC 05-94, released on May 3, 2005, in the above-referenced proceeding.[1]

I. In Addressing SHVERA's Statutory Study Considerations, the Commission Should Be Guided by the Fundamental Nature of the Section 119 Compulsory License

The Satellite Home Viewer Extension and Reauthorization Act of 2004 ("SHVERA")[2] requires the Commission to report to Congress on a variety of factors that may ultimately affect whether a household is deemed to be "unserved" by a digital television signal as that term is defined in the Copyright Act pursuant to 17 U.S.C. § 119(d)(10). While SHVERA specifies certain particular considerations the Commission is to study, as the *Notice* recognizes, the Commission's

[1] The Network Affiliates collectively represent approximately 600 local television stations affiliated with the ABC, CBS, and NBC Television Networks.

[2] Pub. L. No. 108-447, Div. J, Tit. IX (2004), at § 204(b) (codified at 47 U.S.C. § 339(c)(1)).

inquiry must be predicated upon the fundamental nature of the "unserved household" limitation set forth in the Copyright Act. That fundamental nature is a compulsory license operating in derogation of the property rights of copyright holders which should, accordingly, always be conservatively construed in favor of the local broadcast station.

The Section 119 "unserved household" provision permitting the limited importation of a distant duplicating network signal in a narrow set of circumstances has been an element of copyright law since the original Satellite Home Viewer Act ("SHVA") in 1988. In the Copyright Act, Congress, pursuant to its constitutional authority in the Copyright Clause, Art. I, § 8, cl. 8, has granted an exclusive, albeit time-limited, right in original works of authorship fixed in a tangible medium of expression.[3] A copyright, therefore, is a constitutionally- and congressionally-sanctioned property right. One of the principal exclusive rights subsisting in copyright is the right to choose whether and how one's copyrighted works can be distributed to others.[4]

SHVA (as did the Satellite Home Viewer Improvement Act of 1999 ("SHVIA") and now SHVERA) granted a limited and conditional compulsory copyright license to satellite carriers to enable them to distribute distant network signals to a narrow class of viewers—a class of viewers that has shrunk even further under SHVERA, as explained below. This compulsory license is an express limitation on the distribution rights of creators of original works of expression, and, thus, is in derogation of the normally broad power to exercise control over one's copyrighted works.[5] The

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[3] *See* 17 U.S.C. § 102(a).

[4] *See* 17 U.S.C. § 106(3).

[5] *See* U.S. Copyright Office, *A Review of the Copyright Licensing Regimes Covering Retransmissions of Broadcast Signals* (Aug. 1, 1997) ("*Copyright Office Report*"), at 13 ("A compulsory license mechanism is in derogation of the rights of authors and copyright owners." (continued...)

compulsory license permits satellite carriers to retransmit copyrighted material without having to obtain the express permission of the owner. Compulsory licenses are not favored in the law and, therefore, are narrowly construed. As stated by the Fifth Circuit, because a "compulsory license provision is a limited exception to the copyright holder's exclusive right to decide who shall make use of his [copyrighted work] . . . it must be construed narrowly, lest the exception destroy, rather than prove, the rule."[6]

Each of the satellite laws has had a dual purpose: (1) to enable households located beyond the reach of a local affiliate, primarily in rural areas,[7] to obtain access to broadcast network

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(...continued)
(internal quotation marks and citation omitted)).

[6] *Fame Publ'g Co. v. Alabama Custom Tape, Inc.*, 507 F.2d 667, 670 (5th Cir.), *cert. denied*, 423 U.S. 841 (1975).

[7] Reviewing the legislative history of the original SHVA and its 1994 renewal demonstrates that the original intent of Section 119 was to enable satellite carriers, through a compulsory license mechanism, to provide broadcast network service to *rural* areas:

> [The bill] will benefit *rural America*, where significant numbers of farm families are inadequately served by broadcast stations licensed by the Federal Communications Commission.

H.R. REP. NO. 100-887, pt. 1, at 15 (1988) (emphasis added).

> The extension of the SHVA "ensure[s] that *rural home satellite dish consumers* will be able to continue to receive retransmitted broadcast programming. This is essential because in many rural areas satellite technologies represent the only way that *rural families* can receive the kind of information and entertainment programming that many urban Americans take for granted."

140 CONG. REC. E1770 (daily ed. Aug. 19, 1994) (statement of Rep. Long) (emphases added).

> The extension of the SHVA is needed "to ensure that *rural consumers* will continue to receive television programming."

(continued...)

programming by satellite and (2) to protect the integrity of the copyrights that make possible the existing free, over-the-air national network/local affiliate broadcast distribution system.[8]

Section 119, therefore, has always represented a careful balance between the public interest, on the one hand, in allowing households located beyond the reach of a local network station to secure access to broadcast network programming and, on the other hand, in preserving "localism" by protecting the copyrights each local network station has for the broadcast of its network programming in its local market. Each of these laws was designed to protect the exclusivity of the copyright held by each affiliate for exhibition in its market of its network programming.[9] At the heart of these laws is an acknowledgment by Congress of the national interest in preserving "local" broadcast service by protecting the longstanding, free, universally-available, over-the-air national network/local affiliate television distribution system—a system Congress acknowledged "has served the country well."[10]

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[7](...continued)
140 CONG. REC. H9268, H9270 (daily ed. Sept. 20, 1994) (statement of Rep. Hughes) (emphasis added).

This same basis has been expressed in the legislative history of SHVERA:

> Its [the Section 119 license] primary purpose is to ensure that those residing in *rural* areas or in areas where terrain makes it impossible to receive an acceptable over-the-air signal from their television stations can receive a "*life-line*" network television service from a satellite provider.

H.R. REP. NO. 108-660, at 10 (2004) (emphases added).

[8] *See* H.R. REP. NO. 100-887, pt. 1, at 8 (1988); H.R. REP. NO. 108-660, at 11 (2004).

[9] *See* H.R. REP. No. 100-887, pt. 2, at 19-20 (1988); H.R. REP. NO. 100-887, pt. 1, at 14 (1988).

[10] H.R. REP. NO. 100-887, pt. 2, at 20 (1988); H.R. REP. NO. 108-660, at 11 (2004).

Localism is a bedrock principle of the nation's broadcast television system. "[T]he Commission historically has followed a policy of 'localism' as a sound means of promoting the statutory goal of efficient public service."[11] Indeed, the Commission has acknowledged that "our commercial television system is based upon the distribution of programs to the public through a multiplicity of local station outlets. [W]e have not turned to an alternative system of signal and program distribution, based upon a handful of 'super stations.'"[12]

In initiating its first SHVA proceeding, in CS Docket No. 98-201, the Commission recognized the central role that the core policy of localism plays in the Section 119 regime:

> The network station compulsory licenses created by the Satellite Home Viewer Act are limited because Congress recognized the importance that the network-affiliate relationship plays in delivering free, over-the-air broadcasts to American families, and because of the value of localism in broadcasting. Localism, a principle underlying the broadcast service since the Radio Act of 1927, serves the public interest by making available to local citizens information of interest to the local community (e.g., local news, information on local weather, and information on community events). Congress was concerned that without copyright protection, the economic viability of local stations, specifically those affiliated with national broadcast networks, might be jeopardized, thus undermining one important source of local information.[13]

In the resulting *SHVA Order*, the Commission allowed the principle of localism and several important corollaries to guide its decision to recommend to Congress the Individual Location

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[11] *National Ass'n of Broadcasters v. FCC*, 740 F. 2d 1190, 1198 (D.C. Cir. 1984).

[12] *Restrictions on Use of Microwave Relay Facilities to Carry Television Signals to Community Antenna Television Systems*, First Report and Order, FCC 65-335, 4 Rad. Reg. 2d (P & F) 1725 (1965), ¶ 47.

[13] *Satellite Delivery of Network Signals to Unserved Households for Purposes of the Satellite Home Viewer Act*, Notice of Proposed Rule Making, FCC 98-302, 14 Comm. Reg. (P & F) 2163 (1998).

Longley-Rice ("ILLR") predictive 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."[14] *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 viewers who are able to receive their signal."[15] *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."[16] *Fourth*, and finally, the Commission recognized that a "predictive model that includes truly served households in an unserved category, even temporarily, creates . . . undesired effects."[17] These principles must continue to guide the Commission in the instant proceeding.

While SHVIA in 1999 added new sections to the existing SHVA, most notably the Section 122 local-into-local compulsory license for satellite carriers,[18] the Section 119 distant compulsory license provision was reenacted basically unchanged. The Conference Report accompanying passage of SHVIA noted that "the Section 119 regime is largely being extended in

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[14] *Satellite Delivery of Network Signals to Unserved Households for Purposes of the Satellite Home Viewer Act*, Report and Order, 14 FCC Rcd 2654 (1999) ("*SHVA Order*"), at ¶ 11.

[15] *SHVA Order* at ¶ 8.

[16] *SHVA Order* at ¶ 65.

[17] *SHVA Order* at ¶ 77.

[18] *See* 17 U.S.C. § 122.

its current form."[19]

As the SHVIA Conference Report states:

> [T]he specific goal of the Section 119 license is to allow for a *life-line network television 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.[20]

When Congress passed SHVIA, it specifically reiterated its intention to promote the concept of localism. As the Conference Report accompanying SHVIA further states:

> [T]he Conference Committee reasserts the importance of protecting and fostering the system of television networks as they relate to the concept of localism. It is well recognized that television broadcast stations provide valuable programming tailored to local needs, such as news, weather, special announcements and information related to local activities. *To that end the Committee has structured the copyright licensing regime for satellite to encourage and promote retransmissions by satellite of local television broadcast stations to subscribers who reside in local markets of those stations.*[21]

Congress continued to recognize that allowing satellite carriers to retransmit distant network programming into a local affiliate's market is a violation of a local station's exclusive copyright privileges. The SHVIA Conference Report observes that "allowing the importation of distant or out-of-market network stations in derogation of the local station's exclusive right—bought and paid for in market negotiated arrangements—to show the works in question, undermines those arrangements."[22] Congress, therefore, intended that the scope of this extraordinary privilege continue

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[19] Conference Report on H.R. 1554, Intellectual Property and Communications Omnibus Reform Act of 1999, 145 CONG. REC. H11793 (daily ed. Nov. 9, 1999) (hereinafter "SHVIA Conference Report").

[20] SHVIA Conference Report, 145 CONG. REC. H11792-H11793 (emphasis added).

[21] SHVIA Conference Report, 145 CONG. REC. H11792 (emphasis added).

[22] SHVIA Conference Report, 145 CONG. REC. H11792.

to be extremely narrow. As the SHVIA Conference Report further recognized:

> [P]erhaps most importantly, the Conference Committee is aware that in creating 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* to minimize the effects of the government's intrusion on the broader market in which the affected property rights and industries operate.[23]

Against this consistent historical backdrop, Congress in SHVERA, in another full explication of these same underlying principles, continued to express its recognition of the need to minimize the abrogation of the rights of local broadcast stations:

> The abrogation of copyright owners' exclusive rights and the elimination of transaction costs for satellite carriers are valuable accommodations that benefit the DBS industry. The terms and conditions of § 119, therefore, are crafted to represent a careful balance between the interests of satellite carriers who seek to deliver distant broadcast programming to subscribers in a manner that is similar to that offered by cable operators, and the need to provide copyright owners of the retransmitted broadcast programming fair compensation for the use of their works.
>
> [. . .]
>
> An element of the § 119 license since inception, the unserved household limitation has been a central tenet of congressional policy on distant signal carriage. Its primary purpose is to ensure that those residing in rural areas or in areas where terrain makes it impossible to receive an acceptable over-the-air signal from their television stations can receive a "life-line" network television service from a satellite provider.
>
> Where a satellite provider can retransmit a local station's exclusive network programming but chooses to substitute identical programming from a distant network affiliate of the same network instead, the satellite carrier undermines the value of the license negotiated by the local broadcast station as well as the continued viability of the network-local affiliate relationship. . . .
>
> The Committee has consistently considered market-negotiated exclusive arrangements that govern the public performance of broadcast programming in a given geographic area to be preferable to statutory mandates. Accordingly, a second purpose of the unserved

[23] SHVIA Conference Report, 145 CONG. REC. H11792 (emphasis added).

> household limitation is to confine the abrogation of interests borne by copyright holders and local network broadcasters to only those circumstances that are absolutely necessary to provide the "life-line" service.[24]

But SHVERA is not merely a continuation of the Section 119 *status quo ante*. Rather, SHVERA, building upon the local-into-local Section 122 compulsory license enacted in SHVIA, begins to *phase out* the Section 119 distant compulsory license. Although the definition of "unserved household" has not been substantively changed, the class of viewers to whom satellite carriers may retransmit distant duplicating network signals has been considerably narrowed through the principle of "if local, no distant." Thus, Section 103 of SHVERA, codified in 17 U.S.C. § 119(a)(4), creates a new limitation on the applicability of the distant signal license, greatly restricting its applicability where local-into-local retransmissions are available. Section 204 of SHVERA, codified in 47 U.S.C. § 339(a)(2), creates a Communications Act analogue to the Copyright Act amendment. The new, fundamental limitation imposed by SHVERA is the *ineligibility* for distant network signals of satellite subscribers who are able to obtain access to the local network signals of local broadcast stations via local-into-local service offered pursuant to the Section 122 license. This principle applies as fully to digital signals as it does to analog signals.[25] The relationship between localism and the congressional policy preference for local-into-local service was expressed by Congressman Buyer as follows:

> The act imposes a variety of limits designed to protect free, local, over-the-air broadcasting. . . . Put another way, local-to-local service is the right way, and—except when there is no other choice—distant network stations are the wrong way, to deliver broadcast programming by satellite. Local-to-local fosters localism and helps

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[24] H.R. REP. NO. 108-660, at 9-11 (2004).

[25] *See* 17 U.S.C. § 119(a)(4)(D); 47 U.S.C. § 339(a)(2)(D).

> keep free, over-the-air television available to everyone, while delivery of distant network stations to households that can receive their own local stations (whether over the air or via local-to-local service) has just the opposite effect.[26]

Currently, DIRECTV offers local-into-local analog service in 133 markets covering 92.53% of the nation's television households.[27] EchoStar offers local-into-local analog service in 157 markets covering 95.25% of television households.[28] Accordingly, the number of households that cannot receive local network stations *either* over the air *or* via local-into-local satellite service is truly minuscule. In addition, DIRECTV has announced its intention to provide local-into-local *digital* service by the end of 2005 in 30-40 of the largest markets in the country, providing local HD service to as many as 60% of television households just as the Commission's report to Congress is due[29]; local HD service to the rest of the country is expected by the end of 2007. When Congress enacted SHVERA with its substantially narrowed Section 119 compulsory license, it acted with

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[26] 150 CONG. REC. H8221-H8222 (Oct. 6, 2004) (statement of Rep. Buyer).

[27] *See DIRECTV Local Channels available at* <http://www.directv.com/DTVAPP/see/LocalChannels_markets.dsp> (visited June 1, 2005).

[28] *See Dish Network Local Channels available at* <http://www.dishnetwork.com/content/programming/locals/index.asp> (visited June 1, 2005).

[29] *See* Mark Seavey, *DirecTV Expects to Have Local HD Available in 30-40 Markets*, COMMUNICATIONS DAILY (June 2, 2005) (citing DIRECTV CEO Chase Carey); *see also DIRECTV's Spaceway F1 Satellite Launches New Era in High-Definition Programming; Next Generation Satellite Will Initiate Historic Expansion of DIRECTV Programming* (Apr. 26, 2005) *available at* <http://phx.corporate-ir.net/phoenix.zhtml?c=127160&p=irol-newsArticle&ID=700828&highlight=> (visited June 1, 2005) (stating that the Spaceway F1 satellite will provide local HD service to 32.8% of television households) ; *DIRECTV Spaceway F2 Satellite will Expand Local Digital/HD Services for DIRECTV Customers; Satellite shipped to French Guiana* (May 25, 2005) *available at* <http://phx.corporate-ir.net/phoenix.zhtml?c=127160&p=irol-newsArticle&ID=713981&highlight=> (visited June 1, 2005) (stating that the Spaceway F2 satellite, and its twin, the Spaceway F1, "will provide the needed capacity to roll out local digital and HD in at least 24 markets this year, representing more than 45 percent of U.S. TV households"). According to Nielsen Media Research, the top 30 markets contain 53.4% of U.S. television households and the top 40 markets contain 60.8% of U.S. television households.

knowledge of this extensive local-into-local service.[30]

Against this background of a long history of minimizing the abrogation of the rights of copyright holders and of preserving and promoting localism, through both over-the-air and local-into-local satellite service, Congress enacted a very special and particularly limited regime for the satellite delivery of duplicating distant *digital* network signals. *First*, in any market where a satellite carrier offers local-into-local digital signals, any subscriber who did not purchase a distant digital signal of the relevant network prior to the commencement of local-into-local digital service would be ineligible for distant digital service. By the end of 2005, as many as 60% of television households subscribing to DIRECTV's service will be able to obtain local-into-local digital service and thus will be ineligible for distant digital service.

Second, in any market where satellite carriers do not offer either local-into-local digital service or local-into-local analog service, only subscribers living in an *analog* white area will be eligible for distant digital service (provided the relevant local affiliate has obtained a special testing waiver pursuant to 47 U.S.C. § 339(a)(2)(D)(viii)(VI) for just such a circumstance). As seen above, less than 5% of television households for EchoStar and less than 8% of television households for DIRECTV are even located in such markets, and the number of satellite subscribers who also live in an analog white area in those markets is virtually *de minimis*. In fact, the number of households who cannot receive local network stations by *any* means can only be counted in the thousands, not in the hundreds of thousands, and certainly not in the millions.

Third, in a market where a satellite carrier does not offer local-into-local digital service but

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[30] *See* 150 CONG. REC. H8222 (Oct. 6, 2004) (statement of Rep. Buyer) (citing local-into-local service figures and acknowledging DIRECTV's announcement of its plans for local HD service).

does offer local-into-local analog service, if a satellite subscriber lives in an analog white area *and* purchases the local analog signal of the relevant network, then that subscriber is eligible for a distant digital signal. Although not ideal for the local network station since DTV coverage can exceed analog coverage, because the Commission intended that a station's digital facility only replicate its analog coverage area, Congress made the policy determination that such a subscriber unserved by the over-the-air analog signal would likely be unserved by the over-the-air digital signal. Moreover, Congress required that the subscriber "buy-through" the local-into-local analog service in order to obtain the distant digital service so that its local signal would still be received by the satellite subscriber.

Fourth, and the primary category of relevance to this proceeding, in a market where a satellite carrier does not offer local-into-local digital service but does offer local-into-local analog service (as in the third category, *supra*), if the satellite subscriber is *served* over the air by the local station's analog signal, then such a subscriber *may* be eligible for distant digital service provided a site test measurement, under certain further conditions as to market, date, and DTV build-out status and conducted pursuant to the current test methodology set forth in Section 73.686(d) of the Commission's rules, demonstrates that the household cannot receive a digital signal of signal intensity that exceeds the DTV signal intensity standards set forth in Section 73.622(e)(1) of the Commission's rules.

As enacted, the digital "unserved household" scheme is virtually self-executing. SHVERA specifies the circumstances under which a subscriber may be eligible for a distant digital signal; specifies conditions under which a household site test may occur, including the beginning dates on which testing can begin for certain markets; specifies the initial objective test methodology; and specifies the DTV signal intensity standard the site measurement must exceed. Notably absent from

this digital "unserved household" scheme as enacted is a predictive model. That is, eligibility for distant digital service for subscribers falling into the fourth category delineated above can *only* be determined by a household site test. Given the "if local, no distant" principle, given the local-into-local analog service "buy-through" requirement, and given the reliance on an *analog* white area determination in many circumstances, Congress obviously intended that actual household site tests for digital signal intensity be few and far between in order to protect the investments of local stations in the DTV transition.

What is left, then, for the Commission in this proceeding, like the Section 119 license itself, is narrow, requiring a conservative approach to respect the limited nature of the compulsory license and to preserve the integrity of the localism principle. Although SHVERA lists six specific items that the Commission is to study in this proceeding, logically these items may be reclassified into three separate, but ultimately interrelated, concerns: (1) the appropriateness of the DTV planning factors which resulted in the digital signal intensity standards set forth in Section 73.622(e)(1); (2) the appropriateness of the objective analog signal site test methodology in Section 73.686(d) in the digital signal context; and (3) the advisability of developing a predictive model for future use. In addressing these issues, the starting point must always be a clear recognition that Congress has already made the policy determination to protect the exclusive arrangement the local network affiliate has made with its network partner and that distant service should only be available as a "life-line" for those subscribers for whom it is *impossible* to receive a local digital signal.

II. The DTV Planning Factors Established Appropriate Signal Strength Thresholds for Reception of Real-World Digital Broadcast Signals

In its DTV proceeding, the Commission decided to predicate the coverage area of the new DTV service upon each station's existing NTSC Grade B service area. The Commission's goals

were two-fold: first, to provide DTV coverage comparable to a station's current coverage area and, second, to provide the best correspondence between the size and shape of the proposed DTV channel's coverage area and the station's existing coverage.[31] The Commission carefully crafted this approach to "foster the transition to DTV, while simultaneously preserving viewers' access to off-the-air TV service and the ability of stations to reach the audiences they now serve."[32] Maintaining viewer "access to the stations that they can now receive over-the-air" was a critical component of the DTV replication scheme.[33] Thus, the value of over-the-air service to both viewers and broadcasters was fundamental to the Commission's actions. Obviously, the Commission would not have predicated DTV—for which broadcasters have invested many millions of dollars—on planning factors intended to replicate existing television service if those factors were not, in fact, adequate or up to the task.

DTV service areas are defined in terms of the geographic area within which a station's noise-limited field strength is expected to exceed a pre-determined field strength level at 50% of the locations 90% of the time, i.e., F(50,90). That pre-determined field strength depends on the broadcast band and is derived from the DTV planning factors intended, as stated above, to replicate NTSC service areas. The DTV noise-limited field strength standards are 28 dBu for the low VHF band, 36 dBu for the high VHF band, and 41 dBu for the UHF band,[34] which have been rounded up to the nearest whole number. The relationship between the planning factors and the requisite noise-

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[31] *See Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service*, Sixth Report and Order, 12 FCC Rcd 14588 (1997) ("*Sixth DTV Report and Order*"), ¶ 12.

[32] *Sixth DTV Report and Order* at ¶ 14.

[33] *Sixth DTV Report and Order* at ¶ 29.

[34] *See* 47 C.F.R. § 73.622(e)(1).

limited field strength is shown in Table 1.[35]

DTV Planning Factors *Table 1*

Parameter	Channels 2 to 6	Channels 7 to 13	Channels 14 to 69
Thermal Noise	(106.2)	(106.2)	(106.2)
Dipole Factor	111.8	120.8	130.8
System Noise Figure	10	10	7
Downlead Line Loss	1	2	4
Receiving Antenna Gain	(4)	(6)	(10)
Carrier-to-Noise Ratio	15.2	15.2	15.2
Median Field Intensity	27.8 dBu	35.8 dBu	40.8 dBu

As the *Notice* correctly states—and critical to the Commission's entire DTV plan to replicate NTSC Grade B service areas—"[*t*]*hese criteria presume that households will exert similar efforts to receive DTV broadcast stations as they have always been expected to exert to receive NTSC analog TV signals.*"[36] As the discussion below of each of these planning factors demonstrates, the Commission's existing noise-limited field strength thresholds for DTV service are more than adequate for real-world reception of local digital broadcast signals.[37]

Thermal Noise. Thermal noise is a function of the laws of physics. It has not and will not change. The Commission's planning factor for thermal noise is appropriate as is.

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[35] *See Sixth DTV Report and Order* at Appendix A & Appendix B; OET Bulletin No. 69, *Longley-Rice Methodology for Evaluating TV Coverage and Interference* (revised Feb. 6, 2004) ("OET 69"), at Table 3.

[36] *Notice* at ¶ 6 (emphasis added).

[37] *See generally* Engineering Statement of Jules Cohen, P.E. ("Cohen Engineering Statement"), at 1-5 (attached hereto as an Appendix).

Dipole Factor. The dipole factor is also a function of the laws of physics. However, the dipole factor is dependent upon frequency, and in the DTV planning factors the Commission utilized the geometric mean frequency of a UHF band extending from 470 MHz to 806 MHz (Channels 14 to 69). But the DTV transition is not just about migrating to digital broadcasting, it is also about reallocating Channels 52 to 69 (698 MHz to 806 MHz) to other services. Because the core DTV channels extend only to Channel 51—and the only channels for which digital site testing will ever occur are located in the core—the dipole factor should be recalculated on the basis of the geometric mean frequency of the UHF band extending from 470 MHz to 698 MHz (Channels 14 to 51). The geometric mean frequency of the core UHF band is 573 MHz, which results in a dipole factor of – 130.2 dB.

Carrier-to-Noise Ratio. The carrier-to-noise ratio of 15.2 dB (15.19 dB) for DTV is derived from measurements of the Grand Alliance system conducted by the Technical Subgroup of the Advisory Committee on Advanced Television Service.[38] Thus, the carrier-to-noise ratio is empirically derived and represents the minimum ratio of signal strength to noise adequate for a digital receiver to decode the data and produce a digital picture.

Downlead Line Loss. The Commission has long recommended the use of RG-6 coaxial cable for television reception installations.[39] RG-6 coaxial cable is a shielded cable for which

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[38] *See Sixth DTV Report and Order* at Appendix A; Advisory Committee on Advanced Television Service, *Final Technical Report* (Oct. 31, 1995), at Table 5.1.

[39] *See* Philip B. Gieseler *et al*., *Comparability for UHF Television: Final Report* (Office of Plans and Policy Sept. 1980) ("*UHF Comparability Final Report*"), at 69 (stating that "RG-6 coax offers very good performance" and that "an RG-6 system is a good value because the coaxial systems offer even less performance variability than shielded twin-lead; and coax is much easier to manipulate than shielded twin-lead, and, therefore, presents fewer installation problems").

"wetness and metal proximity ma[k]e no change in the attenuation characteristics."[40] As the Commission recently reported to Congress following SHVIA: "[T]here is no serious question that RG-6 is clearly the preferred and recommended choice that consumers residing near the Grade B contours of TV stations would typically employ . . . ."[41]

RG-6 coax cable is commonly available. Based on current specifications for such readily available RG-6, attenuation for 50 feet is as follows[42]:

Low VHF	0.75 dB to 0.93 dB
High VHF	1.31 dB to 1.44 dB
UHF	2.20 dB to 2.76 dB

where the range provides the loss from the lowest to the highest channel in each band. Based on these current data, it is plain that transmission line loss occurring in 50 feet of recommended RG-6 coaxial cable is, for low VHF, less than 1 dB; for high VHF, less than 2 dB; and for UHF, less than 3 dB. Therefore, the Commission's DTV planning factor for downlead line loss is a little conservative.[43]

Receiving Antenna Gain. SHVERA requires the Commission to examine a number of

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[40] *UHF Comparability Final Report* at 60. *See also* Improvements to UHF Television Reception, *Report and Order*, 90 F.C.C.2d 1121 (1982), ¶ 50 (noting that RG-6 is a good quality cable).

[41] *Technical Standards for Determining Eligibility for Satellite-Delivered Network Signals Pursuant to the Satellite Home Viewer Improvement Act*, Report, 15 FCC Rcd 24321 (2000), at ¶ 28.

[42] *See* Channel Master Coaxial Cable and Wire *available at* <http://www.channelmaster.com/Pages/TVS/Cable.htm> (providing cable attenuation values at various frequencies for Channel Master's RG-6 Coaxial Cable—Pro Install Series). The UHF band was considered only through Channel 51 (mid-frequency 695 MHz).

[43] *Cf. Technical Standards for Determining Eligibility for Satellite-Delivered Network Signals Pursuant to the Satellite Home Viewer Improvement Act*, Report, 15 FCC Rcd 24321 (2000), at ¶ 28 (stating that the "transmission loss planning factor values for Grade B provide a conservative margin for this type [RG-6] of coaxial cable").

considerations concerning antennas. In order to do so, it is necessary to determine whether the basis for the receiving antenna gain assumed in the DTV planning factors is reasonable. Television receiving antennas have, of course, been a component of a home television receiving installation for more than 50 years, and existing consumer antennas are capable of receiving both analog and digital television signals.

The Commission itself has recommended that consumers use "[s]eparate UHF and VHF outdoor antennas" because separate antennas will "provide better performance on UHF than can a combination UHF/VHF antenna, at little or no extra cost."[44] Therefore, in determining appropriate gain figures, what is relevant are the results of analyses of separate VHF and UHF antennas.

The Commission and its staff have recognized that the best UHF antenna, considering both performance and value, is an eight-bay bowtie-with-screen antenna.[45] An FCC-sponsored study in 1980 determined that the average gain for such an antenna is 13.4 dB.[46] In fact, the Electronics Technicians Association—the group that actually installs and works in the field with antennas on a day-to-day basis—stated in its Comments in CS Docket No. 98-201 that the eight-bay and four-bay bowtie-with-screen antennas "are *the* conventional UHF antennas for fringe rural areas."[47] Antennas

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[44] *Improvements to UHF Television Reception*, Report and Order, 90 F.C.C.2d 1121 (1982), ¶ 50; *see also UHF Comparability Final Report* at xiii, 52, 83.

[45] *See Improvements to UHF Television Reception*, Report and Order, 90 F.C.C.2d 1121(1982), ¶¶ 47-51 & Appendix B; *UHF Comparability Final Report* at xiii, 50 n.8, 51, 83.

[46] *See Improvements to UHF Television Reception*, Report and Order, 90 F.C.C.2d 1121(1982), at Appendix B; *UHF Comparability Final Report* at 51; W.R. Free *et al.*, *Final Report, Program to Improve UHF Television Reception*, Project No. FCC-0315 (Georgia Inst. of Tech., Eng'g Experiment Station, Sept. 1980) ("*UHF Antenna Report*").

[47] Comments of the Electronics Technicians Association, International, Inc. (hereinafter "Electronics Technicians Association" and "Electronics Technicians Association Comments") in CS Docket No. 98-201, at 23 (emphasis added).

with higher average UHF gains are available, although they are slightly more expensive. For example, one parabolic UHF antenna possessed an average gain of 14.6 dB.[48] The UHF Comparability Task Force used an average UHF antenna gain of 14.3 dB in one part of its analysis.[49] Each of these gain figures is well in excess of the 10 dB gain assumed in the DTV planning factors for UHF.

Pursuant to the *Notice*'s request for information on currently available antennas,[50] the Network Affiliates have compiled data from several leading manufacturers of consumer television antennas which are attached hereto as Exhibit 1. As can be seen from these data, Channel Master offers an eight-bay bowtie-with-screen UHF antenna, Model No. 4228, with an average gain of 12.0 dB. Winegard offers a UHF antenna designed for deep fringe areas, the Model PR-9032, with a gain of 15.6 dB. Antennas Direct also offers a long-range UHF antenna, Model 91XG, with a gain of 16.7 dB.[51] In short, there is no question that the Commission's DTV planning factor for UHF antenna gain, 10 dB, is very conservative and can easily be achieved with readily available consumer UHF antennas.

The most recent study of VHF antennas of which the Network Affiliates are aware was conducted by the Institute for Telecommunications Sciences ("ITS"), an arm of the Department of Commerce, in 1979. That study indicates that the average gain in the low VHF band is 4.43 dB and

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[48] *See Improvements to UHF Television Reception*, Report and Order, 90 F.C.C.2d 1121 (1982), at Appendix B (citing *UHF Antenna Report*).

[49] *See UHF Comparability Final Report* at 76 (Table 3-10) (citing *UHF Antenna Report*).

[50] *See Notice* at ¶ 11.

[51] *See* Exhibit 1. The Channel Master 4228 retails for $38.99 from Solid Signal (solidsignal.com). Winegard's PR-9032 retails for $34.99 from Solid Signal. Antenna Direct's Model 91XG sells for $79 (antennasdirect.com).

in the high VHF band is 8.34 dB.[52] These gains exceed the relevant DTV planning factor gains for the VHF bands.

Currently, Antennacraft manufactures a VHF antenna, Model CS1100, with an average gain in the low VHF band of 6.9 dB and an average gain in the high VHF band of 9.6 dB. Channel Master offers a VHF antenna, Model No. 3610, with an average gain in the low VHF band of 5.8 dB and an average gain in the high VHF band of 11.4 dB. Winegard offers a VHF antenna, Model HD4053P, with a gain between 5.9 dB and 6.6 dB in the low VHF band and a gain between 9.6 dB and 11.1 dB in the high VHF band.[53] Again, there is no question that the Commission's DTV planning factors for low VHF gain, 4 dB, and for high VHF gain, 6 dB, are also very conservative and can easily be achieved with readily available consumer VHF antennas.

Although combination VHF/UHF antennas do not generally perform as well as separate VHF and UHF antennas, there are consumer models available that still handily exceed the assumed gains in the DTV planning factors. For example, Winegard's Model HD7084P has gains of from 6.2 dB to 7.6 dB in the low VHF band, from 10.8 to 12.0 in the high VHF band, and from 11.8 dB to 14.6 dB in the UHF band. Antennacraft's Model HD1850 has an average gain of 6.2 dB in the low VHF band, 10.7 dB in the high VHF band, and 10.0 in the UHF band.[54] Even Channel Master's

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[52] *See* R.G. FitzGerrell *et al.*, *Television Receiving Antenna System Component Measurements*, Report No. 79-22 (NTIA June 1979) (cited in Philip B. Gieseler *et al.*, *Comparability for UHF Television: A Preliminary Analysis* (Office of Plans and Policy Sept. 1979), at 45 (Table 3-1)).

[53] *See* Exhibit 1. The Antennacraft CS1100 has a list price of $96.08 (antennacraft-tpd.com). Winegard's HD4053P retails for $119.99 from Solid Signal (solidsignal.com). Pricing information on Channel Master's 3610 is not available.

[54] *See* Exhibit 1. The Winegard HD7084P retails for $127.99 from Solid Signal (solidsignal.com). Antennacraft's HD1850 has a list price of $174.97 (antennacraft-tpd.com).

eight-bay bowtie-with-screen UHF antenna, Model No. 4228, has been measured by an independent engineer, Kerry Cozad of Dielectric Communications, to possess an average gain of approximately 3.0 dB in the low VHF band, approximately 9.0 dB in the high VHF band, and approximately 15.0 dB in the UHF band (which exceeds the manufacturer's own specifications).[55]

Such high-gain antennas are not appropriate for all receiving locations. Where signal strength is already adequate, or nearly adequate, such a high-gain antenna could overload the receiver. For circumstances such as these, antenna manufacturers produce smaller antennas with less gain. But even if the gain of such an antenna is less than the gain assumed in the planning factors, that does not mean the planning factors are defective. At such locations, the ambient signal strength will already exceed the thresholds established by the planning factors. The Consumer Electronics Association ("CEA"), in conjunction with Decisionmark, has created a website, AntennaWeb.org, that is designed to assist consumers in selecting an appropriate outdoor receiving antenna. It is evident from the website that CEA does not recommend a large high-gain antenna for all locations and all circumstances. In fact, CEA has introduced an antenna labeling program with six different categories, ranging from small, medium, and large antennas that are either directional or multi-directional, and the AntennaWeb.org website recommends an antenna from one or more of these categories depending on the consumer's location in relation to the location, distance, and predicted signal strength of various desired television station signals.

Although it is not an element affecting the digital signal intensity standards, the Commission did assume that the receiving antenna would have a directional gain pattern in order to discriminate

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[55] *See* Kerry W. Cozad, *Measured Performance Parameters for Receive Antennas Used in DTV Reception* (text available from the author at kerry.cozad@dielectric.spx.com).

Once again, the Channel Master 4228 retails for only $38.99 from Solid Signal (solidsignal.com).

against off-axis undesired stations and, therefore, ameliorate interference. In fact, the ATSC recommends the use of a directional gain antenna to enhance *receiver* performance with respect to multipath: "[A]n antenna with a directional pattern that gives only a few dB reduction in a specific multipath reflection can dramatically improve the equalizer's performance. Such modest directional performance can be achieved with antennas of consumer-friendly size, especially at UHF."[56] Accordingly, an element of the DTV planning factors is the front-to-back ratio of the receiving antenna, which the Commission assumed to be 10 dB for low VHF, 12 dB for high VHF, and 14 dB for UHF. (Incidentally, these front-to-back ratios greatly exceed those assumed for analog television reception, which was 6 dB across all bands.)[57]

It is common for readily available consumer antennas to meet or exceed these assumed front-to-back ratios. Thus, of the antennas mentioned in the text above for which data are available, the front-to-back ratio of Channel Master's eight-bay bowtie-with-screen UHF antenna, Model No. 4228, exceeds 19 dB at all UHF frequencies and is 24 dB at Channel 43. These front-to-back ratios far exceed the 14 dB assumed in the DTV planning factors. Similarly, the front-to-back ratio of Winegard's UHF Model PR-9032 is 14 dB at Channel 14 and 20 dB at both Channel 32 and Channel 50, which meets or substantially exceeds the assumed front-to-back ratio for the UHF band.[58]

Consumer VHF antennas appear to easily exceed the assumed front-to-back ratios for the low VHF and high VHF bands. Thus, Antennacraft's previously mentioned VHF antenna, Model

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[56] *ATSC Recommended Practice: Receiver Performance Guidelines*, Doc. A/74 (June 18, 2004), at 24.

[57] *See* OET 69 at Table 6.

[58] *See* Exhibit 1.

CS1100, has a front-to-back ratio of 19.4 dB in the low VHF band and 17.6 dB in the high VHF band. The front-to-back ratio of Winegard's VHF Model HD4053P is 17 dB or greater across both the low VHF and high VHF bands.[59]

It appears that VHF/UHF combination antennas also greatly exceed the Commission's assumed front-to-back ratios for the low VHF and high VHF bands and just meet the assumed front-to-back ratio for the UHF band. For instance, the front-to-back ratio of Winegard's VHF/UHF combination antenna, Model HD7084P, is 20 dB or greater in the low VHF band, 15 dB or greater in the high VHF band, and is 11 dB at Channel 14 and 20 dB at both Channel 32 and Channel 50. The front-to-back ratio of Antennacraft's VHF/UHF combination antenna, Model HD1850, is 20.2 dB in the low VHF band, 17.3 dB in the high VHF band, and 13.7 dB in the UHF band.[60]

In addition to the specific numerical values of antenna gain and front-to-back ratio, the DTV planning factors, more generally, are, as stated in OET 69, "assumed to characterize the equipment, including antenna systems, used for home reception."[61] As the instant *Notice* aptly summarizes it: "These criteria presume that households will exert similar efforts to receive DTV broadcast stations as they have always been expected to exert to receive NTSC analog TV signals."[62] In the past, the Commission has always assumed that homeowners would employ an outdoor, directional gain antenna for over-the-air reception of television signals. Because of the directional nature of the receiving antenna, a typical installation also utilizes a rotor so that the antenna may be properly oriented. In addition, in fringe areas where signal strength is known to be weak, the typical home

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[59] *See* Exhibit 1.

[60] *See* Exhibit 1.

[61] OET 69 at 3.

[62] *Notice* at ¶ 6.

installation uses a low-noise amplifier ("LNA"), also known as a pre-amplifier.

As the Commission has previously explained in the analog context but whose basic principles apply equally in the digital context:

> A radio frequency (RF) preamplifier is a device that is utilized in a receiving antenna system to increase the RF power of the desired signal delivered to the receiver. In a television receiving system, a preamplifier can improve overall system performance by both compensating for the decrease in signal strength (attenuation) caused by the transmission line and components, and by lowering the amount of noise, or snow, the receiving antenna system contributes to the displayed image. The degree to which the preamplifier affects the transmission line attenuation and system noise depends on its own gain and the amount of noise internally generated by the preamplifier (which to a certain extent are a function of its cost) and where in the receiving antenna system the preamplifier is installed. If the preamplifier is located at the antenna, the overall amount of noise in the picture will be established by the noise characteristic of the preamplifier, because its gain can then compensate for most, if not all, of the signal attenuation due to the transmission line and components. . . . When mounted at the terminals of an outdoor antenna, a preamplifier can provide its maximum degree of picture quality improvement.[63]

The UHF Comparability Task Force itself noted that "[p]reamplifiers have historically been utilized in 'fringe' reception areas."[64] The Electronics Technicians Association—again, the group that installs antennas—stated in its comments in CS Docket No. 98-201 that, in its home county in rural Indiana, "*virtually all* rooftop antenna systems include a pre-amplifier."[65] And the ATSC has also recommended LNAs for digital reception: "Many reception problems can be mitigated by use

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[63] *UHF Comparability Final Report* at 73-74.

[64] *Id.* at 78.

[65] Electronics Technicians Association Comments, CS Docket No. 98-201, at 6 (emphasis added).

of a mast-mounted low-noise amplifier (LNA). Currently, several manufacturers sell LNAs."[66]

The gain achievable with an LNA is more than sufficient to ensure the adequacy of the digital signal intensity standards in fringe areas.[67] For example, the pre-amplifier the UHF Comparability Task Force used in one study, which was chosen because of its good performance characteristics and relatively low price, possessed a gain of 16 dB and an internal noise figure of 3.7 dB, for an aggregate advantage of 12.3 dB.[68] The Electronics Technicians Association stated in CS Docket No. 98-201 that typical gains with current pre-amplifiers are 17 dB to 24 dB.[69]

Current offerings of LNAs from several manufacturers are compiled in Exhibit 2. For instance, Winegard currently offers 16 different LNAs with gains ranging from 17 dB to 29 dB. One of their LNAs, Model AP-8275, provides an average gain of 29 dB for VHF and 28 dB for UHF with an internal noise figure of only 2.9 dB and 2.8 dB in those respective bands.[70] Channel Master offers an LNA, Model 7777, with an average gain of 23 dB for VHF and 26 dB for UHF with an internal noise figure of 2.8 dB for VHF and only 2.0 dB for UHF.[71] Antennacraft offers an LNA with adjustable gain to prevent receiver overload. This model, Model 10G212, provides an average gain

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[66] *ATSC Technology Group Report: DTV Signal Reception and Processing Considerations*, Doc. T3-600r4 (Sept. 18, 2003), at 37.

[67] *Cf. Technical Standards for Determining Eligibility for Satellite-Delivered Network Signals Pursuant to the Satellite Home Viewer Improvement Act*, Report, 15 FCC Rcd 24321 (2000), at ¶ 32 (stating that, "where needed, the combination of a smaller low gain antenna and an inexpensive low noise amplifier at the antenna terminals can easily provide an effective gain equal to the planning factor values").

[68] *See UHF Comparability Final Report* at 75 n.18, 76 (Table 3-10 n.3).

[69] *See* Electronics Technicians Association Comments, CS Docket No. 98-201, at 14-15.

[70] *See* Exhibit 2. Winegard's AP-8275 LNA retails for $77.99 from Solid Signal (solidsignal.com).

[71] The Channel Master 7777 LNA retails for $56.99 from Solid Signal (solidsignal.com).

of 30 dB for both VHF and UHF with a noise figure of less than 4.0 dB for VHF and less than 3.5 dB for UHF. This model's list price is only $33.63 (antennacraft-tpd.com).[72]

Specialty LNAs are also available from manufacturers such as Blonder Tongue and Advanced Receiver Research. Advanced Receiver Research manufactures single channel LNAs with exceptionally low noise figures. For example, single channel low VHF LNAs are available with a gain of 24 dB and a noise figure of only 0.5 dB. Advanced Receiver Research also manufactures a broadband UHF LNA with narrow tune capability with a gain of 15 dB and a noise figure of 0.6 dB.[73] Blonder Tongue not only makes single channel LNAs, but it makes broadband LNAs with exceptionally high gain figures. For instance, Blonder Tongue's Vaulter III Plus model provides a gain of 31 dB in the VHF band and a gain of 38 dB in the UHF band with a noise figure of 4.5 dB across all bands.[74]

In addition to LNAs, the Commission has always expected and recognized that

> persons living in areas located in the outer reaches of the service areas of broadcast stations (for example, at the edge of a predicted Grade B contour) can, and generally do, take relatively simple measures such as installation of an improved roof-top antenna and careful location and orientation of that antenna to enhance their off-the-air reception.[75]

In fact, the Commission expressly advised that "[a]ntennas should be installed by 'probing' for the best receiving location; signal strength can vary significantly over a very short distance; thus, the

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[72] *See* Exhibit 2.

[73] *See* Exhibit 2. Prices for these specialty LNAs from Advanced Receiver Research are not available online, but comparable models for other applications appear to list for approximately $80 and up (advancedreceiver.com).

[74] *See* Exhibit 2. The Blonder Tongue Vaulter III Plus LNA retails for $99.99 from Solid Signal (solidsignal.com).

[75] *Cable Communications Policy Act Rules*, Second Report and Order, FCC 88-128, 64 Rad. Reg. 2d (P & F) 1276 (1988), ¶ 18.

antenna should be installed at the location that provides good picture quality for the channels desired."[76]

As the Electronics Technicians Association showed in CS Docket No. 98-201, the majority of home antenna systems in Putnam County, Indiana, a location representative of the outer reaches of the service areas of broadcast stations, contain a rotor (in addition to an LNA)—and this is true, as the Electronics Technicians Association further remarked, even though homeowners in Putnam County can receive network programming from each of the four major networks from affiliates all located in Indianapolis.[77]

In fact, as the Electronics Technicians Association correctly pointed out:

> Rotors are as important in many areas as steering wheels are in automobiles. Because a household needs to reverse the antenna to get a signal 180 degrees from another should not be an excuse to pay $600 over ten years to receive the signal via satellite instead of installing the proper antenna system.[78]
>
> Rotors are economical ($60-$75) and they do not require constant rotation. . . . To circumvent the intent of the SHVA because the homeowner prefers to not invest in a rotor where needed[] is not right.[79]

Channel Master, Antennacraft, and Radio Shack each sell rotors for home antenna installations. Some of these rotors are available with a remote control so the viewer can properly orient the antenna from the couch. A sample of such rotors is compiled in Exhibit 3. Prices for rotors range from $68.99 for the Channel Master with remote control (available from Solid Signal

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[76] Improvements to UHF Television Reception, *Report and Order*, 90 F.C.C.2d 1121 (1982), ¶ 50.

[77] Electronics Technicians Association Comments, CS Docket No. 98-201, at 6.

[78] *Id.* at 21

[79] *Id.* at 24.

(solidsignal.com)) to a list price of $94.88 for the Antennacraft (antennacraft-tpd.com), with the Radio Shack rotor priced in the middle (radioshack.com).

System Noise Figure. It is difficult to obtain data from receiver manufacturers on the specifications, including noise figure, of DTV receivers, and, thus, it is difficult to verify that the assumed noise figures in the DTV planning factors are accurate. However, it has long been recognized that the *system* noise figure is essentially determined by the noise figure of an LNA if the system incorporates such an amplifier, which, as shown above, is standard for fringe reception areas.[80] In fact, not long after the original Grade B planning factors were established for analog broadcasting, it was recognized that the system noise figure could be reduced by as much as 6 dB if an LNA were incorporated into the reception system.[81]

When an LNA is combined with a DTV receiver in a system, the noise figure (NF) of the system is given by the following[82]:

$$NF_{system} = 10 \log_{10} [NF_{LNA} + (NF_{receiver} - 1)/Gain_{LNA}]$$

Thus, when the noise figures of readily available consumer LNAs are considered, it is plain that system noise figures on the order of 3 to 4 dB, far below the assumed system noise figures of 10 dB,

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[80] *See UHF Comparability Final Report* at 73 ("If the preamplifier is located at the antenna, the overall amount of noise in the picture will be established by the noise characteristic of the preamplifier . . . .").

[81] *See* Robert A. O'Connor, *Understanding Television's Grade A and Grade B Service Contours*, BC-14 IEEE TRANS. ON BROADCASTING 137, 142 (Dec. 1968) ("[M]ost receivers now have noise figures considerably better than indicated. This is particularly true in the outlying areas where the use of low-noise, moderate-gain antenna-mounted preamplifiers can reduce these figures by as much as 6 dB.").

[82] *See Technical Standards for Determining Eligibility for Satellite-Delivered Network Signals Pursuant to the Satellite Home Viewer Improvement Act*, Report, 15 FCC Rcd 24321 (2000), at ¶ 32 n.115.

10 dB, and 7 dB for the low VHF, high VHF, and UHF bands, respectively, are easily achievable in conventional home reception installations. There is, accordingly, no question that the Commission's DTV planning factor for system noise figure can be considered conservative when viewed in the context of a complete reception system.

Miscellaneous Considerations. Several other considerations are relevant to the adequacy of the Commission's DTV planning factors for real-world reception of DTV signals. Perhaps most importantly, in the early stages of the DTV transition, multipath was known to be more difficult for digital reception than it is for analog reception. In fact, the International Telecommunications Union specifically incorporated an additional cushion into the carrier-to-noise ratio it assumed for its ATSC DTV planning criteria to account for typical multipath reception impairment, making the cushioned C/N ratio 19.5 dB.[83] Fifth generation DTV receivers, which are now commercially available in integrated sets from manufacturers such as LG and Zenith, have made substantial improvements in equalizer architecture and can now handle 50 microsecond pre-ghosts and 50 microsecond post-ghosts.[84] As one recent report summarizes the current state-of-the-art:

> Because of the "all or nothing" nature of digital reception, digital TV must provide excellent reception even where analog reception is poor, in order to facilitate the transition for the large number of receivers that use over-the-air reception. *This is beyond the requirements originally proposed at the inception of digital television, but it is*

[83] *See, e.g.*, International Telecommunications Union, *Draft Revision of Recommendation ITU-R BT.1368-4*, Document 6/BL/32-E (Mar. 22, 2005), at Table 13 and note 1 to table.

[84] *See* Tim Laud *et al.*, *Performance of 5th Generation 8-VSB Receivers*, 50 IEEE TRANS. ON CONSUMER ELECS. 1076 (Nov. 2004); Communications Research Centre Canada, *Results of the Laboratory Evaluation of Zenith 5th Generation VSB Television Receiver for Terrestrial Broadcasting* (Sept. 2003).

being met by 5th generation designs.[85]

Because multipath is not a function of signal strength *per se* and because current fifth generation receivers can handle multipath even in generally poor reception conditions, the Commission's DTV planning factors do not need to be adjusted to account for multipath the way in which the ITU recommended.

In addition, because so few earlier generation DTV receivers are owned by consumers—estimated at no more than 1% penetration[86]—it is clear that virtually all household sets

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[85] *Performance of 5th Generation 8-VSB Receivers* at 1080 (emphasis added).

[86] It is difficult to obtain complete DTV receiver penetration information. In January 2004, in the *Tenth Annual Video Competition Report*, the Commission observed (i) that "[w]hile over 1000 stations are providing a DTV signal, many consumers within those service areas are unable to view the DTV format either because they do not have DTV receivers or because they are subscribers to a MVPD that does not carry the DTV signal," and (ii) that "[f]rom their introduction in August 1998 through the second quarter of 2003, over six million HDTV-capable sets have been sold, but only 700,000 of these [i.e., 11.67%] have been purchased with a built-in tuner or add-on decoder box required for receiving an HDTV broadcast." *Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, Tenth Annual Report, FCC 04-5 (released Jan. 28, 2004), ¶ 96 n.433 & ¶ 103. Updating that data through December 2003, as reported by the Consumer Electronics Association, indicates that approximately 8.88 million DTV units were sold from 1998 through December 2003. *See Holiday Sales Boost DTV Numbers for October and November* (Dec. 18, 2003), *available at* http://www.ce.org/press_room/press_release_detail.asp?id=10375 (stating that the "total number of DTV products sold since introduction in the fourth quarter of 1998 is now 8.24 million units"); *2003 a Banner Year for DTV; Unit Sales Top Four Million* (Jan. 12, 2004), *available at* http://www.ce.org/press_room/press_release_detail.asp?id=10396 (stating that "December 2003 sales totaled 640,443"). That number, of course, represents DTV-*capable* units and necessarily includes sales of units to restaurants, sports bars, and other public venues vis-à-vis private households; the number of DTV *receivers* in actual homes, as the Commission has observed, is far less. Considering that there were more than 108 million television households in the 2003-2004 television season, according to Nielsen Media Research, it is clear that DTV receiver penetration did not reach even 1% by the end of 2003 (((700,000 ÷ 6,000,000) × 8,880,443) ÷ 108,410,160 = 0.96%). Network Affiliates recognize that this calculation does not include sales figures for 2004, but CEA appears not to have separately reported those figures for DTV receivers, and the Commission's *Eleventh Annual Video Competition Report* makes no mention of them either. *Cf. Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, Eleventh Annual Report, FCC 05-13 (released Feb. 4, 2005), ¶ 87 (similar figures (continued...)

do or will contain late generation receiver chips, especially given the effective dates of the Commission's tuner mandates. Indeed, given SHVERA's time table to implement the digital signal site testing regime, it is likely that sixth generation receivers with additional improvements will be commercially available by then. This obviates the need for the Commission to consider whether to artificially boost the digital signal strength thresholds to account for multipath.

It is also worth comparing several of the other assumptions made by the ITU in its ATSC digital planning criteria with those assumed by the Commission. For example, the ITU assumed an antenna gain of 8.2 dB for low VHF, 10.2 dB for high VHF, and 12.2 for UHF.[87] Each of these exceed the antenna gains assumed by the Commission in the DTV planning factors, but, as the Network Affiliates' survey of commercially available antennas demonstrates, each of the ITU's antenna gain assumptions are readily achievable by real-world antennas available for purchase today. In addition, the ITU assumed transmission line loss of 1.1 dB for low VHF, 1.9 dB for high VHF, and 3.3 dB for UHF.[88] The VHF line loss values are virtually identical to those assumed by the Commission, while the UHF line loss value is less. As the specifications for RG-6 coax cable indicate, even the ITU's assumptions remain slightly conservative. Finally, for receiver noise figure, the ITU assumed 5 dB for both low VHF and high VHF and 10 dB for UHF.[89] These assumed noise

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[86](...continued)
as in *Tenth Annual Video Competition Report* not provided). DTV receiver penetration did undoubtedly increase in 2004, but the imbedded base of DTV receivers is still low, and, more importantly, any DTV receivers sold in 2004 would have contained later generation chips (fourth or fifth generation), which only underscores the point that there are very few early generation DTV receivers in consumers' hands.

[87] *See Draft Revision of Recommendation ITU-R BT.1368-4* at Table 13.

[88] *See Draft Revision of Recommendation ITU-R BT.1368-4* at Table 13.

[89] *See Draft Revision of Recommendation ITU-R BT.1368-4* at Table 13.

figures for VHF are substantially less than—indeed, they are half—what the Commission assumed, while the ITU's UHF noise figure is higher. In any event, each of these noise figures is higher than the system noise figure would be if it incorporated an LNA. The ITU makes additional assumptions that the Commission did not (including incorporating an LNA and an antenna balun, among others), but the end result is signal strength levels generally in line with the Commission's own, 35 dBu for low VHF, 33 dBu for high VHF, and 39 dBu for UHF. What the ITU's independent results do is corroborate that the Commission's 1997 DTV planning factors led to signal strength thresholds that are realistic for real-world reception conditions for a typical receiving installation located near the edge of coverage and for a viewer taking reasonable steps, including an outdoor antenna oriented or orientable to the desired signal and an appropriate receiver, to receive DTV service.

* * *

Based on the above survey of considerations affecting the Commission's DTV planning factors, it is possible to adjust the DTV planning factors to account for what is possible under current real-world *reception* conditions—not NTSC replication conditions. Such adjustments would recognize the minor alteration in the dipole factor for UHF, a slight reduction in downlead line loss for UHF, slightly better receiving antenna gains from readily available outdoor antennas, lesser noise figures in all bands through use of an LNA (without even accounting for the additional gain to the receiving installation from the amplification provided by the LNA), and the ability of fifth generation DTV receivers to perform well when confronted with substantial pre- and post-ghosts. The results of these minor adjustments are shown in Table 2.

***Adjusted* DTV Planning Factors** *Table 2*

Parameter	Channels 2 to 6	Channels 7 to 13	Channels 14 to 69
Thermal Noise	(106.2)	(106.2)	(106.2)
Dipole Factor	111.8	120.8	130.2
System Noise Figure	4	4	4
Downlead Line Loss	1	2	3
Receiving Antenna Gain	(6)	(10)	(12)
Carrier-to-Noise Ratio	15.2	15.2	15.2
Median Field Intensity	19.8 dBu	25.8 dBu	34.2 dBu

Network Affiliates do not recommend that the Commission actually propose to Congress these adjusted planning factors as the basis for digital signal strength thresholds for site testing purposes. Rather, what these adjusted planning factors show is that the current planning factors, in a proper receive installation, have plenty of "headroom"—a "safety margin," as the Commission has termed it[90]—to ensure that quality DTV reception is achievable precisely where the Commission expected it to be—in the replicated NTSC coverage area where 50% of the viewers would be able to receive acceptable service 90% of the time. In fact, that "headroom" or "safety margin" ensures that substantially more than 50% of the viewers are able to receive acceptable service 90% of the time or, equivalently, that 50% of the viewers are able to receive acceptable service substantially in excess of 90% of the time.[91] This level of coverage is more than the Commission ever anticipated in adopting the DTV planning factors, and it clearly demonstrates that the Commission need not

[90] *Technical Standards for Determining Eligibility for Satellite-Delivered Network Signals Pursuant to the Satellite Home Viewer Improvement Act*, Report, 15 FCC Rcd 24321 (2000), at ¶ 68.

[91] In addition, the "headroom" may be thought of as providing a margin of safety for any "slippage" in the receive system, such as, for example, a minor loss of signal strength due to an impedance mismatch.

recommend artificially boosting the planning factors for SHVERA purposes, which would be contrary to the limited purpose of SHVERA's ever narrower distant signal license.

The discussion of the adequacy of the DTV planning factors, the specifications and characteristics of currently available consumer equipment, and the Commission's intentions and expectations in promulgating the DTV planning factors, together with Congress's long history of minimizing the abrogation of the rights of copyright holders and of preserving and promoting localism and the network-affiliate distribution system and with the nature of the particularly limited—and now even narrower—regime for the satellite delivery of duplicating distant digital network signals, all appropriately drive consideration of the inquiries required by SHVERA and set forth in the *Notice*. All of these considerations point ineluctably to the following conclusions:

First, the receiving antenna must be mounted outside on the roof or adjacent to the house. Moreover, the antenna must be oriented to the desired signal, and if the desired stations are not located in the same direction, then the antenna must be orientable in the direction of the desired signal(s).[92] In addition to all of the above considerations which point to this natural conclusion, it is worth observing that satellite receive antennas are mounted outside and are oriented to the satellite. It would be inappropriate to essentially penalize a local television station for a consumer who was only willing to install an indoor antenna or an antenna that was not capable of being oriented to the desired signal, especially when the consumer is willing to take additional, necessary steps to obtain adequate satellite reception. Consequently, there is no need for the Commission to consider modifying the inherent assumptions regarding DTV antenna receiving systems in the DTV

[92] *See Notice* at ¶ 9.

planning factors.[93] An excellent antenna receiving system can be installed at relatively low cost. For example, the Channel Master Model 4228 eight-way bowtie-with-screen antenna, which even has adequate gain at VHF frequencies, costs only $39, and it can be paired with the Channel Master rotor with remote control for $69, for a complete system price of only $108. If additional gain were necessary or there were a desire or need to lower the system noise figure, the Antennacraft Model 10G212 LNA with adjustable gain can be added to the receive installation for an additional $33.63.

Second, the Commission should continue to recommend that the current signal strength thresholds for noise-limited digital service should be used to define the availability of a DTV signal for determining whether a household is eligible to receive distant digital signals from satellite services.[94] As stated above, real-world equipment, including fifth generation receivers, demonstrates that the Commission's current signal strength thresholds are more than adequate to receive a high-quality digital picture. There is no basis to artificially boost the current signal strength thresholds. And there is certainly no basis to retreat from a signal strength standard altogether when that can only jeopardize localism and the network-affiliate distribution system while running counter to the extremely narrow compulsory license that remains in SHVERA for satellite delivery of duplicating distant network signals.

Third, variation in DTV set prices should play no role in determining whether a household is unserved by an adequate DTV network signal.[95] The evidence shows that there is very little penetration (no more than 1%) of early generation DTV receivers in television households. Most

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[93] *See Notice* at ¶ 11.

[94] *See Notice* at ¶ 14.

[95] *See Notice* at ¶ 16.

households have or will acquire DTV sets with integrated tuners incorporating the latest generational chip design (fifth generation or later), including equalizers demonstrating superior multipath handling performance capabilities. With digital tuners manufactured in mass quantities to satisfy the Commission's tuner mandate, the cost of an integrated DTV set is not particularly dependent on the cost of the generation of chip design (say, fourth generation versus fifth generation). Instead, DTV set prices are largely dependent on features, such as ATSC format capabilities (enhanced definition versus high definition, particularly in smaller-sized models), screen size, screen technology (CRT, plasma, LCD, DLP), screen resolution, contrast ratio, and integration of other functions, such as digital video recorders ("DVRs"). For example, a survey of the Sharp Aquos and LG websites revealed no difference in the type of ATSC tuner included in integrated DTV sets within each manufacturer's product lines. It would make a mockery of the principle of localism, and of the objective standards Congress has always imposed on the "unserved household" definition, to permit a satellite carrier to deliver a duplicating distant network signal to a household merely because the household had purchased, probably unknowingly, an inferior quality DTV set. The current analog "unserved household" definition is not dependent on whether a household buys a $59 13-inch television set or a $400 27-inch television set. There is no reasonable, defensible basis to make such a distinction in the digital context. Moreover, there is no workable basis to incorporate a receiver quality factor into a site testing regime, given the many dozens, if not hundreds, of consumer DTV sets available for purchase in the market. Finally, as the *Notice* appears to recognize,[96] any limitations in fifth generation receiver design are likely to be highly mitigated by using higher performance antennas with high front-to-back ratios and auxiliary devices such as rotors and LNAs.

[96] *See Notice* at ¶ 17.

Fourth, multipath should not be taken into account in determining whether a household is served by an adequate digital signal.[97] As shown above, fifth generation receivers incorporate equalizers that are remarkably good at handling very early pre-ghosts and very late post-ghosts (on the order of 50 microseconds each). But, more fundamentally, multipath is not a matter of signal strength, which is the objective means by which a digital "unserved household" should be determined. The effects of multipath, however, can be greatly, if not wholly, mitigated by the use of the latest generation receiver; by the use of an outdoor antenna raised to 30 feet which will place the antenna far above the principal multipath reflectors, including moving vehicles such as cars, trucks, and buses, as well as neighboring houses; and by the use of highly directional antennas with high front-to-back ratios, properly oriented to the strongest desired signal. As the ATSC has observed: "[A]n antenna with a directional pattern that gives only a few dB reduction in a specific multipath reflection can *dramatically* improve the equalizer's performance. Such modest directional performance can be achieved with antennas of consumer-friendly size, especially at UHF."[98] In addition, the Commission refused to include multipath within the distant analog signal eligibility standard,[99] and there is no principled basis to include multipath in the distant digital signal eligibility standard since there still remains no objective means to predict or evaluate multipath at any particular location or to evaluate the impact of multipath on local television service generally.

In sum, the only way to respect the Commission's own history of implementing the DTV

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[97] *See Notice* at ¶ 20.

[98] *ATSC Recommended Practice: Receiver Performance Guidelines*, Doc. A/74 (June 18, 2004), at 24 (emphasis added).

[99] *See Technical Standards for Determining Eligibility for Satellite-Delivered Network Signals Pursuant to the Satellite Home Viewer Improvement Act*, Report, 15 FCC Rcd 24321 (2000), at ¶ 59.

service, to respect the narrow and limited purpose of the distant signal compulsory license, and to respect the bedrock principle of localism in television service is for the Commission to recommend to Congress that its existing signal strength thresholds remain the objective standards by which the eligibility of a household for duplicating distant digital signal service should be determined.

III. The Commission's Objective Test Methodology for Analog Signals Is Generally Sound but Must Be Modified Slightly to Test Objectively the Signal Strength of Digital Broadcast Signals

Section 73.686(d) of the Commission's rules sets forth the testing procedure for cluster measurements of signal strength at household locations. This methodology was developed specifically for analog signals, but it is generally workable for digital signals once several slight modifications are made to measure the signal strength of digital signals.[100]

First, a directional gain antenna should be utilized instead of a half-wave dipole. Since the objective of the site test is to determine whether adequate signal strength exists to deliver high-quality DTV reception, use of a directional gain antenna that can be oriented to the strongest desired signal and that can ameliorate any difficulties that could be caused by multipath at the site would represent a better engineering practice than use of a half-wave dipole in these circumstances.

Second, there is no visual carrier for digital signals, so the requirement in Section 73.686(d)(2)(i) to measure the visual carrier makes no sense in the digital context. The *Notice*'s suggestion to substitute the pilot signal for the visual carrier is not feasible.[101] The Commission defines digital signals by their integrated average power over the 6 MHz bandwidth. It is this integrated average power that should be measured to determine the field strength. Because

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[100] *See* Cohen Engineering Statement at 6-7.

[101] *See Notice* at ¶ 13.

the 6 MHz bandwidth of the digital channel will contain many sharp peaks and valleys and because the pilot signal, which is already down 3 dB, could fall within a valley, there is little likelihood that measurement of the pilot signal will tell one anything useful about the actual signal strength of the digital signal. Again, the field strength of a digital signal should be determined by measuring the integrated average power over the 6 MHz bandwidth.

Third, a typical analog field strength meter cannot be used to measure digital signal strength since its bandwidth is too narrow. Instead, the tester should use a spectrum analyzer tuned to the center of the channel, sweep across a variety of small intermediate frequency bandwidths, and integrate the total power across the 6 MHz bandwidth.

With these slight modifications, the testing methodology in Section 73.686(d) will permit the objective testing of the signal strength of digital signals. But this is true only if the remaining elements of the testing methodology are not altered. Most notably, the site test must measure signal strength *outdoors*, at the specified rooftop heights (20 feet for one-story residences, 30 feet for all others), and with the testing antenna properly oriented.[102] The Commission should not consider developing specific procedures for measuring signal strength indoors.[103] As explained extensively above, DTV service was designed to provide a service that would replicate existing Grade B analog service, and that existing Grade B analog service was always predicated upon providing satisfactory service to 30-foot outdoor antennas, properly oriented, located at households near the fringe of the station's service area. Local service will simply be eviscerated if the Commission were to recommend measuring signal strength indoors or establishing an indoor standard that the entire DTV

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[102] *See* 47 C.F.R. § 73.686(d)(2)(iii), (iv).

[103] *See Notice* at ¶ 13.

service was never intended to be able to meet.

Of course, the test methodology must remain objective. There is neither any basis nor any warrant for the Commission to consider altering any aspect of the test methodology that would add any element of subjectivity to the test. As one third party has explained it:

> [S]ubjective tests are only applicable for development purposes. They do not lend themselves to operational monitoring, production line testing, trouble shooting or repeatable measurements required for equipment specifications. Subjective testing is too complex and provides too much variability in results, making clear the need for an objective testing method of picture quality.[104]

Finally, *what* is to be measured is as important as *how* it is to be measured. And there are numerous circumstances in which what is to be measured is not digital signal strength but analog signal strength. As noted above, in a market, for example, where a satellite carrier does not offer local-into-local digital service but does offer local-into-local analog service, if the satellite subscriber is served over the air by the local station's analog signal, then such a subscriber may be eligible for distant digital service depending on the results of a site test measurement in conjunction with certain further conditions as to market, date, and DTV build-out status. Digital signal strength is to be measured at the site test only for those stations for which the SHVERA trigger events in 47 U.S.C. § 339(a)(2)(D)(vii) are satisfied. For all other stations, the site test must continue to measure *analog* signal strength, even though it is eligibility for a distant *digital* duplicating network signal that is in issue.

This principle is best demonstrated by an example. In local Market L, which is a top 100 market, the local ABC affiliate is Station X. Station X has received a tentative DTV service channel

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[104] Tektronix White Paper, *A Guide to Maintaining Video Quality of Service for Digital Television Programs* (Feb. 2000), at 3.

designation that is the same as its current DTV channel in the core. Station X also operates two translators T1 and T2. In an adjacent market, Market A1, which is a top 100 market, the local ABC affiliate is Station Y. Although Market A1 is a top 100 market, Station Y has received a testing waiver pursuant to 47 U.S.C. § 339(a)(2)(D)(viii) because Station Y has a side-mounted digital antenna that causes it to experience a substantial decrease in its digital signal coverage area. In another adjacent market, Market A2, which is not a top 100 market, the local ABC affiliate is Station Z. If, on July 1, 2006, a satellite subscriber located in Market L seeks to have a site test conducted to determine the subscriber's eligibility for a distant digital duplicating ABC signal, then the site test must measure the following: (1) the *digital* signal strength of Station X (because the SHVERA trigger events are satisfied for Station X, *see* 47 U.S.C. § 339(a)(2)(D)(vii)(I)(aa)), (2) the *analog* signal strength of translator stations T1 and T2 (because the trigger events for translator stations are not yet satisfied, *see* 47 U.S.C. § 339(a)(2)(D)(vii)(II)), (3) the *analog* signal strength of Station Y (because Station Y obtained a digital testing waiver for a valid reason, *see* 47 U.S.C. § 339(a)(2)(D)(viii)(IV)), and (4) the *analog* signal strength of Station Z (because the trigger events for stations that are not in the top 100 markets are not yet satisfied, *see* 47 U.S.C. § 339(a)(2)(D)(vii)(I)(bb)). Only if the location of the subscriber's household cannot receive the requisite signal strength (be it digital or analog, as stated) from *any* of these stations would the subscriber be deemed eligible to receive a distant digital signal. Therefore, even if the subscriber's location is unable to receive the requisite signal strength of Station X's digital signal, if the location can receive the requisite signal strength of Translator T1 *or* Translator T2's analog signal *or* the requisite signal strength of Station Y's analog signal *or* the requisite signal strength of Station Z's analog signal, then the subscriber is *not* eligible for a distant digital ABC signal. (It should be remembered that the subscriber in this case is not left without life-line network service. Before the

testing could even occur in this example, SHVERA requires the subscriber to be receiving local Station X's ABC programming as part of the satellite carrier's local stations package offered under the Section 122 local-into-local compulsory license.)

A testing regime implemented as described herein best comports with SHVERA and Congress's long-standing policy goals to protect and preserve localism and to retain the extremely limited character of the distant signal compulsory license.

IV. The Longley-Rice Model Is an Appropriate Predictive Model to Recommend to Congress for Future, But Not Immediate, Use

SHVERA, unlike SHVIA, does not contain a requirement that the Commission promulgate a predictive model to presumptively determine whether an individual location can receive a digital signal of a certain threshold intensity.[105] Although Congress considered requiring the development of a predictive model for digital signals,[106] in the end it did not enact such a scheme. SHVERA, therefore, contains only a requirement for objective site testing to determine the adequacy of digital signal strength, and such testing can only occur after certain future trigger dates. The Commission, accordingly, has no authority to promulgate and implement a predictive model for digital signals.[107]

SHVERA, instead, directs the Commission only to "consider whether to develop a predictive methodology for determining whether a household is unserved by an adequate digital signal under

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[105] *Compare* 47 U.S.C. § 339(c)(1) (enacted in SHVERA) *with id.*, § 339(c)(3) (enacted in SHVIA).

[106] *See* S. REP. NO. 108-427, at 8-9 (2004).

[107] *See INS v. Cardoza-Fonseca*, 480 U.S. 421, 442-43 (1987) (stating that "[f]ew principles of statutory construction are more compelling than the proposition that Congress does not intend *sub silentio* to enact statutory language that it has earlier discarded in favor of other language" (internal quotation marks and citations omitted)).

section 119(d)(10) of Title 17."[108] Network Affiliates believe that the Commission should develop and recommend a predictive model for digital signals, but only for future, and not immediate, use. By "future use," Network Affiliates mean *after* the digital transition is *complete.* Before the end of the transition, too much is unknown, the process would be too complicated, and the resulting viewer confusion could be rampant.

For example, not all stations have made elections for their final digital channel, and the spectrum repacking process is far from complete. Importantly, digital service for low power stations and translators has not yet been authorized. Because a household is considered "served" if it receives a signal from any station, be it full power, satellite, or translator, affiliated with the network in issue,[109] it is not possible to predict whether a household can receive a digital signal if the station that could be delivering the signal has not yet been authorized to broadcast in digital or the station has not yet had a reasonable opportunity to construct digital facilities. Local network affiliates, particularly those in western states that rely heavily on translators, should not be penalized by having their viewers siphoned away to distant duplicating stations solely because they are unable to provide a digital signal through no fault of their own. This is the antithesis of preserving and promoting localism and the network-affiliate distribution system as well as giving an expansive capability to a compulsory license intended to be, and that by law must be, narrowly construed.[110]

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[108] 47 U.S.C. § 339(c)(1)(B)(iv).

[109] *See* 17 U.S.C. § 119(d)(2), (3), (10).

[110] Theoretically, it would be possible to predict whether a location is served by a *digital* signal of any station that does not have a Commission-sanctioned reason for not broadcasting in full power on its final DTV channel and, if not, to then predict whether that location is served by an *analog* signal of any station that does have such a Commission-sanctioned reason, but this process quickly becomes too complicated, too unworkable, and too subject to rampant confusion. Moreover, (continued...)

Consequently, Network Affiliates urge the Commission to recommend that no predictive model be implemented until the digital transition is complete. Waiting for the completion of the digital transition will not materially prejudice the distant signal license for a number of reasons. For instance, the delay will be minimal since the transition should be complete not long after SHVERA's testing scheme is fully triggered, and, of course, a site test would always be available in such circumstances. In addition, given SHVERA's "if local, no distant" policy, the need for a predictive model as well as for site testing should be rapidly diminishing over time as satellite carriers introduce local-into-local digital service into markets. Moreover, waiting for the completion of the digital transition also appears to have been Congress's intent.[111] Finally, the distant signal license existed for many years under SHVA without a predictive model, and it can do the same in the digital context, although the time frame is expected to be much less. When the relative harms are weighed, it is plain that the harm to local affiliates by permitting a predictive model to presume lack of service before the end of the digital transition is too great to be implemented prematurely.

After the completion of the digital transition, it would be appropriate to utilize a predictive model for digital signals, and Network Affiliates urge the Commission to recommend the Longley-Rice model for use in this Section 119(d)(10) context. Not only is DTV coverage predicated upon the Longley-Rice model, as set forth in OET 69, but both the broadcast and satellite

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[110](...continued)
such a hybrid process does not appear to be what Congress intended the Commission to consider and recommend.

[111] *See* H.R. REP. NO. 108-634, at 19-20 (2004) (stating that SHVERA requires the Commission to recommend "a methodology for determining whether a particular consumer would be unserved over the air by the digital signal of a specific network as transmitted by a broadcast station *after* the broadcasters in that consumer's market have ceased to broadcast in analog because of implementation of section 309(j)(14) of the Communications Act" (emphasis added)).

industries have five years of experience with the modified Individual Location Longley-Rice ("ILLR") model described in OET Bulletin No. 72 ("OET 72").[112] Furthermore, Congress intended for the Commission to base its recommended predictive methodology on the ILLR model.[113]

It would be appropriate for the Commission to recommend the ILLR model for digital signal prediction purposes—with one exception. The ILLR model as currently structured in OET 72 over-provides for clutter at UHF frequencies, and, in the digital context, these UHF clutter loss values make the model less accurate, rather than more accurate.[114]

Predictive models such as Longley-Rice already account for clutter factors such as buildings and vegetation inasmuch as they are empirically-based. As the Longley-Rice Manual explains, the model combines certain theoretical treatments

> using empirical relations derived as fits to measured data. This combination of elementary theory with experimental data makes it a *semi-empirical* model . . . .
>
> *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.*[115]

The fact that Longley-Rice is semi-empirical and incorporates the then-existing clutter in the model

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[112] OET Bulletin No. 72, *The ILLR Computer Program* (July 2, 2002).

[113] *See* H.R. REP. NO. 108-634, at 20 (2004) ("The Committee intends the FCC to base its methodology on the FCC's existing technical specifications for digital television service and the individual location Longley-Rice algorithm.").

[114] *See* Cohen Engineering Statement at 5-6.

[115] G.A. Hufford *et al.*, *A Guide to the Use 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 (emphases added); *see also id.* at 22.

is well-recognized in the scientific and technical community.[116]

In creating the ILLR model, the Commission was careful to include additional clutter, above and beyond that already accounted for in the semi-empirical model itself, only where it made the model more accurate. Thus, the Commission determined that any clutter loss values greater than 0 dB would make the model less accurate in the low VHF and high VHF bands for analog signal predictions. With respect to the analog UHF band, the Commission proposed modest clutter loss values for certain land use categories (between 3 dB and 6 dB for the lower half of the UHF band and between 5 dB and 8 dB in the upper half of the UHF band). The Commission determined that these UHF clutter factors, when analyzed with real-world data for over-predictions and under-predictions, made the model the most accurate.[117]

In the case of digital signal predictions, the clutter considerations already inherent in the basic Longley-Rice model provide a more accurate predictive model than the additional UHF clutter loss values added into the ILLR model in OET 72. The National Association of Broadcasters ("NAB") is providing extensive data (more than 2000 individual site predictions with associated measured

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[116] *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 & 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 & 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").

[117] *See Establishment of an Improved Model for Predicting the Broadcast Television Field Strength Received at Individual Locations*, First Report and Order, 15 FCC Rcd 12118 (2000), at ¶¶ 13-15 & Appendix A, Table 3.

field strengths) in its comments in this proceeding providing empirical support for this new modification to the ILLR model. NAB shows, using the same basic form of analysis that the Commission undertook in creating the ILLR model, that the best balance of over-predictions and under-predictions—and, hence, the most accurate predictive model—is provided by the Longley-Rice model without the OET 72 UHF clutter loss values.

In sum, Network Affiliates urge the Commission to recommend to Congress that it prescribe the Longley-Rice predictive model, without the OET 72 UHF clutter loss values, for use after the digital transition is complete in presumptively determining whether an individual location can receive a digital signal of the requisite threshold intensity.

Conclusion

For the foregoing reasons, Network Affiliates respectfully request that the Commission recommend to Congress (1) that the digital signal strength thresholds set forth in Section 73.622(e)(1) remain the same for purposes of determining whether a household is "unserved" by a digital signal pursuant to 17 U.S.C. § 119(d)(10); (2) that the testing methodology set forth in Section 73.686(d) be modified slightly, as explained herein, so that the procedure may be used for digital signal site tests; and (3) that Congress prescribe a slightly modified ILLR model, as explained herein, to be used after the digital television transition is complete to presumptively determine the eligibility of a household to receive a duplicating distant digital network signal.

Respectfully submitted,

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June 17, 2005

Appendix

Engineering Statement of Jules Cohen, P.E.

JULES COHEN, P.E.
Consulting Engineer

ENGINEERING STATEMENT IN SUPPORT OF COMMENTS
FCC NOTICE OF INQUIRY, ET DOCKET NO. 05-182

This engineering statement, prepared on behalf of Network Affiliates, is in support of comments responding to the Commission's Notice of Inquiry In the Matter of Technical Standards for Determining Eligibility For Satellite-Delivered Network Signals Pursuant To the Satellite Home Viewer Extension and Reauthorization Act, ET Docket No. 05-182, released May 3, 2005. The statement is directed, particularly, to the equipment employed to intercept the desired digital signal and the effect of that equipment on Planning Factors. Included also are comments on field testing of the availability of an adequate digital signal from a local terrestrial television broadcast station.

As a threshold matter, the criteria employed to determine eligibility for satellite-delivery of network signals should include an assumption that the receiving point apparatus includes equipment appropriate for the location of the household. Generally, that implies that distant locations use outdoor antennas of reasonably high gain, preferably supplemented by a mast-mounted low noise amplifier. Although at distances relatively close to the transmitter site indoor antennas may suffice for a satisfactory viewing experience, some locations may be so obstructed by terrain, either natural or man-made, that they require equipment generally considered necessary only for distant locations. Additionally, in each instance, the antenna should be assumed to be oriented toward the strongest signal arriving from the desired station. At times, that strongest signal may not be on the direct bearing to the transmitting station but may be from a

nearby water tower or large surface reflecting the desired signal.

Receiving Antennas

Outdoor antennas for fringe area reception are available from numerous sources. Web site listings can be found for such manufacturers as Andrew Channel Master, Antennas Direct, Winegard and AntennaCraft as well as for numerous retail outlets carrying the antennas of these manufacturers and others. Manufacturers' specified antenna gains vary from averages of 5 to 7 dB for low band VHF, mostly about 10 dB for high VHF and 12 dB or more for UHF. Half-power beam widths are in the order of 70 degrees for low VHF, 35 degrees for high VHF and 35 to 40 degrees for UHF. List prices for individual VHF and UHF or all-band high gain outdoor antennas are in the order of $100 to $165 with lower prices found at the times of special sales.

A useful collection of measured patterns of receiving antennas from a source independent of receiving antenna manufacturers is a paper delivered by Mr. Kerry W. Cozad at the 54th Annual IEEE Broadcast Symposium on October 14, 2004. An even more extensive description of Mr. Cozad's work is found in a paper he delivered at the 2005 National Translator Convention on May 15, 2005.

Rotators

Where television transmitting sites are located at a variety of bearings from the receiving location an antenna rotator is required. Rotators capable of handling the outdoor antennas are available from Radio Shack, Channel Master and others at a cost of about $75 plus about $15 for 100 feet of control cable, permitting adjustment to the optimum orientation from a location at the receiver. Manufacturers provide manuals to

guide the householder on the installation of antennas and rotators so that the cost of hiring an installer can be avoided if desired.

Low-Noise Amplifiers

Mast-mounted low noise amplifiers, at reasonable costs of 60 to 90 dollars, are readily available from equipment suppliers, either via the internet or retail outlets. They perform the useful function of assuring high quality digital television reception at marginal locations. A feature of their use is the substantial improvement of the system noise figure over that provided by the television receiver alone.

System noise figure is equal to the sum of the amplifier noise figure plus the noise figure of the receiver divided by the amplifier gain (all in linear terms). Manufacturers' published noise figures run from 2.5 to about 4.0 dB, with gains varying from 11 to 29 dB. A conservative choice of parameters to illustrate the advantage of using a pre-amplifier at the antenna would be: amplifier noise figure 5 dB (3.16), amplifier gain 20 dB (100), and receiver noise figure of 12 dB (15.85). The resulting system noise figure is 3.32, or 5.2 dB. Considering that the system noise factors used by the Commission for DTV reception are 10 dB for VHF and 7 dB for UHF, a system noise figure of approximately 5 dB can be seen to provide an extra margin to minimize the impact of system mismatches.

Planning Factors

Planning factors currently in use by the Commission, as shown in Table 3 of OET Bulletin No. 69, *Longley-Rice Methodology for Evaluating TV Coverage and Interference*, February 06, 2004, is shown in the table on the following page:

PlanningFactor	Symbol	Low VHF	High VHF	UHF
Geometric mean frequency (MHz)	F	69	194	615
Dipole factor (dBm-dBu)	K_d	-111.8	-120.8	-130.8
Dipole factor adjustment	K_a	none	none	see below
Thermal noise (dBm)	N_t	-106.2	-106.2	-106.2
Antenna gain (dBd)	G	4	6	10
Downlead line loss	L	1	2	4
System noise figure (dB)	N_s	10	10	7
Required Carrier to Noise ratio (dB)	C/N	15	15	15

Bulletin 69 states as follows:

> "The adjustment, $K_a = 20 \log[615/(\text{channel mid-frequency in MHz})]$, is added to K_d to account for the fact that field strength requirements are greater for UHF channels above the geometric mean frequency of the UHF band and smaller for UHF channels below that frequency. The geometric mean frequency, 615 MHz, is approximately the mid-frequency of channel 38."

From the foregoing discussion of equipment available, and employed by television viewers, factors such as antenna gain and system noise figure are well within the capabilities of receiving systems. As to downlead losses, they too are conservatively stated in the current planning figures. Losses for 50 feet of RG-6 coaxial cable, the downlead recommended for television use, are shown by Channel Master to be: 0.75 to 0.93 dB for low VHF, 1.31 to 1.44 dB for high VHF, and 2.20 to 2.76 dB for UHF.

Since UHF digital television broadcasting will be limited to channels 14 to 51 (470 to 698 MHz) after the transition, the geometric mean frequency of 615 MHz, based on the use of channels 14 to 69 (470 to 806 MHz), no longer applies in the digital world. The appropriate geometric mean frequency for the new channel alignment is 573 MHz and the dipole factor becomes -130.2. However, in light of an absence for need to change other quantities in the table, the planning factor table is not proposed to be changed.

Prediction of Service

Use of the objective determination of field strength above a suitable threshold level is urged strongly as the criterion of whether or not a particular location has available service from a local terrestrial digital broadcast station. The availability at reasonable cost of sophisticated receiving equipment capable of delivering to the receiver strong signals with suitable carrier-to-noise ratios, coupled with the demonstrated improvements in receiver technology, leaves little doubt that, given sufficient signal strength, the viewer will have excellent digital reception. Multipath degradation that affected early receiver designs has been conquered to a substantial degree. Further improvements have been promised and can be expected to be delivered as the demand for product grows.

A method is already available for making those needed predictions of field strength at particular locations—ILLR. The Commission describes the use of the *Individual Location Longley-Rice (ILLR) Computer Program* in OET Bulletin Number 72 of July 2, 2002. That program has been proved to be reliable through comparison with several thousand measurements of received signal strength. No need exists for a new program with one exception. The clutter loss adjustments for UHF channels should be eliminated. Built into the Longley-Rice Model for the prediction of field strength over

irregular terrain are empirical factors based on actual field strength measurements. Addition of a clutter factor adjustment compounds field strength losses and serves to reduce rather than increase reliability of the prediction.

In rare instances where a party chooses to challenge a prediction of the presence or absence of service, that challenge can be met only with appropriate field strength measurements.

Local Field Strength Measurements

A procedure for making field strength measurements at individual locations is described in Commission rules at 73.686(d). With one major modification, that procedure is appropriate for digital television broadcasting. Section 73.686(d)(2)(i) describes the testing equipment and procedure to follow for measuring the received field strength. The equipment and procedure are appropriate to measurement of a NTSC signal, but not digital.

The field strength desired in the NTSC case is that at the peak of the synchronizing pulse. That is a convenient parameter because the synchronizing pulse has a relatively narrow bandwidth and is independent of the varying video modulation. In the digital case, the necessary measurement is the integrated average power over the full 6 MHz band. Instruments used in the NTSC case cover bandwidth too narrow for measurement of the digital signal. The most practical instrument to use for digital power measurement is a spectrum analyzer such as the Agilent Technologies Model E441B ESA-L (list price about $8,000).

Use of a high gain antenna of known characteristics rather than a dipole is strongly recommended to eliminate to the extent possible interfering signals and to reflect the type of antenna employed by the viewers.

Conclusions

Determining the eligibility for satellite-delivered network stations requires an assumption that receiving equipment appropriate to the point of reception is in use. Threshold signal levels presently used as criteria for acceptable reception in the three TV bands are suitable because the planning factors used to develop those levels are consistent with readily available equipment. The presence or absence of those threshold signal levels is best determined by existing ILLR calculation procedures. In the event of challenge to the analytical results, only field testing is appropriate to reach a definitive conclusion. Field testing should be done by the presently specified procedure with the exception of substituting an appropriate wide-band instrument for the narrow-band field strength meter now used for NTSC.

s/Jules Cohen, P.E.

June 16, 2005