In short, as a matter of law, policy, science, and practicality, the effects of multipath interference should not be included in the Grade B planning factors nor otherwise affect Section 119 eligibility.

IV. The Distinction Between Free, Analog, Over-the-Air Broadcast Television and Pay, Digital Satellite Service Is Critical and Must Not Be Obliterated

NRTC's comments are devoted to one single pernicious goal: To create the unobtainable standard that Section 119 eligibility only be denied if a "household is able to receive an over-the-air signal comparable to the picture quality received by satellite."[150] The terrestrial broadcast industry is spending billions of dollars to convert to DTV; the Commission spent a full decade establishing the framework for the nation's terrestrial DTV system; and Congress granted broadcasters the spectrum necessary to implement DTV. All that would be for naught if NRTC's suggestion should be adopted. The conversion of the terrestrial broadcast system to digital would be set back—if not stopped in its tracks—if the copyright protections local stations hold should be eviscerated by the digital recommendation of NRTC.

The nature of the picture afforded by digital television, be it broadcast DTV or digital

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[149](...continued)
pattern for his or her location—just as it is presumed that a satellite subscriber will locate his or her satellite dish with a direct, unobstructed line of sight to the satellite. *See Notice* at ¶ 27 (inquiring of viewer actions); *see also* IITRI Further Engineering Statement at 13. However, as explained in the text, it is inappropriate to permit ghosting to be part of the Grade B planning factors, and, therefore, it is unnecessary for those factors to somehow account for viewer actions to minimize multipath interference. *See id.* (inquiring of how to account for viewer actions in the Grade B standards).

[150] NRTC Comments at 2; *see also id.* at 6 (same).

satellite service, is totally irrelevant to the question of Section 119 eligibility based on whether a household is capable of receiving an *analog* signal of Grade B intensity. There is simply no warrant—in the statute, in its legislative history, or in common sense—to gut the Act in this way. Moreover, that Congress could have intended no such thing is evident from the fact that Congress, in SHVIA, directed the Commission, separately, to recommend, "if appropriate," "an appropriate standard for digital signals."[151] If the "appropriate standard" for Section 119 eligibility is the picture quality of digital satellite service, as NRTC would have it, then Congress would have said so explicitly and would not have directed the Commission to make recommendations for *two* sets of standards, one "for analog signals"[152] and one "for digital signals."[153]

In addition, as Network Affiliates pointed out in the opening comments, viewer expectations regarding the picture quality of a subscription service such as satellite or cable, for which one must *pay* expensive monthly fees, must not be conflated with viewer expectations regarding the quality of an over-the-air signal, which one receives *free*.[154] Clearly,

> [c]onsumers who *pay* for their TV service may—and, indeed, should—expect to receive a picture quality that is better than what they receive for free. It would be patently unfair to impose a higher standard on broadcasters who provide their signals for free . . . .[155]

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[151] 47 U.S.C. § 339(c)(1).

[152] 47 U.S.C. § 339(c)(1)(A).

[153] 47 U.S.C. § 339(c)(1)(B).

[154] *See* Joint Comments of Network Affiliates at 15.

[155] *Id.* (emphasis in original).

This obvious point was also echoed by NAB and MSTV.[156] Indeed, the Commission essentially recognized this same point in the *Notice* when it noted the bias in certain viewer expectation studies

> conducted by cable television sponsors using as subjects viewers who may have expected to receive, and to pay for, higher quality pictures. Those subjects, however, may not be representative of audiences relying on over-the-air reception for their television viewing.[157]

NRTC's argument is a brazen attempt to destroy localism and eviscerate the property rights that network affiliates hold in their copyrighted programming by making virtually every household in America eligible for distant network service.[158] NRTC's proposed standard is baseless and should be rejected.

V. The ILLR Model Has Already Been Modified to Take Additional Account of Clutter

EchoStar twice asserts that the Commission's recommendations to Congress resulting from this proceeding "must . . . include clutter loss factors and other contributors to signal degradation, such as terrain, building structures, and other land cover variations."[159] EchoStar further asserts that it is the "revised [Grade B] criteria" that must include these clutter loss factors.[160] While it is true that SHVIA requires the Commission to engage both in an examination of the Grade B planning factors and to prescribe a point-to-point predictive model that takes into account terrain, building

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[156] *See* Comments of NAB at 31; Comments of MSTV at 15 n.41.

[157] *Notice* at ¶ 14.

[158] *See* Comments of NAB at 31.

[159] EchoStar Comments at 2 (emphasis as in original); *see id.* at i (same).

[160] *Id.* at 2.

structures, and other land cover variations, there is no serious question that Congress intended these to be two separate requirements.[161] Indeed, the Commission has acted properly in accordance with the statutory requirements, issuing the instant *Notice* in ET Docket No. 00-90 with regard to the Grade B planning factors and already concluding its initial rulemaking in ET Docket No. 00-11 with regard to the ILLR model.[162] In ET Docket No. 00-11, the Commission did, in fact, prescribe a modified ILLR model that takes additional account of clutter.[163]

Clutter is not properly a phenomenon that affects Grade B signal intensity generically, as do the other Grade B planning factors. Rather, clutter is path dependent and, therefore, more appropriately handled through the ILLR model, which, of course, predicts path loss along a specified path to an individual location. Because EchoStar did not further develop how clutter loss factors should be incorporated into the Grade B planning factors, Network Affiliates submit that the Commission need not deal with the matter any further in the instant docket.

Conclusion

As the foregoing evidence conclusively demonstrates, the existing Grade B signal intensity standard is more than adequate to provide an acceptable quality television picture for today's viewers receiving the signals of their local network affiliates over the air. If anything, the most recent engineering data support a *substantial reduction* in the current Grade B values. The real significance of these current values is that television viewers receiving a signal of Grade B intensity are actually

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[161] *Compare* 47 U.S.C. § 339(c)(1) *with id.* § 339(c)(3).

[162] *See generally ILLR Order.*

[163] *See id.*

receiving a picture with a quality essentially two TASO Grades better than they are theoretically predicted to receive.

Multipath interference should not be incorporated as a factor in the Grade B planning factors. Ghosting is a problem, to the extent it is a serious problem at all, that is largely correctable by the viewer. Critically, for purposes of SHVIA, it is virtually impossible to predict ghosting—no party has presented a means to do so—and, without the ability to predict it, an elaborate mechanism for evaluating ghosting impairments is pointless.

There is no warrant in SHVIA or its legislative history to gut the Section 119 eligibility criterion by erasing the critical distinction between *free*, analog, over-the-air broadcast television and *pay*, digital satellite service. To recast eligibility based on whether a viewer receives a digital satellite quality picture from analog over-the-air broadcast stations will destroy localism and eviscerate the property rights that network affiliates hold in their copyrighted programming.

For the foregoing reasons, as well as those contained in the opening comments, Network Affiliates urge the Commission to recommend to Congress that no changes be made to its longstanding and thoroughly-vetted Grade B signal intensity standard.

Respectfully submitted,

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July 12, 2000

Exhibit 1

ALL STATE LEGAL 800-222-0510 FORM RECYCLED

FURTHER ENGINEERING STATEMENT IN SUPPORT OF REPLY COMMENTS RELATED TO FCC ET DOCKET NO. 00-90 NOTICE OF INQUIRY

11 JULY 2000

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FURTHER ENGINEERING STATEMENT IN SUPPORT OF REPLY COMMENTS RELATED TO FCC ET DOCKET NO. 00-90 NOTICE OF INQUIRY

BACKGROUND

In response to the recently enacted Satellite Home Viewer Improvement Act of 1999 (SHVIA), the FCC has released a Notice of Inquiry (NOI) in ET Docket No. 00-90 to obtain information for evaluating whether the signal intensity standard used to determine the eligibility of satellite television subscribers to receive retransmitted distant signals of network stations should be modified or replaced. The existing standard cites the Grade B signal intensity values that have long been used within the television broadcast service. The FCC is seeking information and comment in the NOI on all technical parameters that could be considered to affect the quality of over-the-air reception of television programming. The FCC is also seeking information and comment on an appropriate eligibility standard for digital signals. Based on the record that will be developed, the FCC will submit findings on this issue to Congress.

The NOI was released by the FCC on 26 May 2000, and comments from eight organizations or individuals were received by the Commission.

APPROACH

After the cutoff date for filing comments, IITRI accessed the FCC Electronic Comment Filing System (ECFS) and obtained the comments that had been filed pertaining to the NOI in ET Docket No. 00-90. The comments were reviewed, and, based on the cited materials and our engineering experience and judgment, IITRI provides further comments on the following technical areas identified in the various comments filed before the Commission.

1.) Consumer Expectations

2.) Receiver Noise Figure

3.) Transmission Line Loss

4.) Receiving Antenna Gain and Optimization

5.) Dipole Factor and Thermal Noise

6.) Urban Noise

7.) Peak Visual Carrier to RMS Noise Ratio for Acceptable Picture Quality

8.) Ghosting and Multipath

1.) Consumer Expectations

Some may argue that consumer expectations are higher today than 50 years ago. Today, many commonly available and premium services provide television programming. Analog cable, digital cable, digital direct broadcast satellite television (DBS), and analog (C-band) satellite services are available. Of these, a case can be made that the service provided by analog cable and analog satellite are actually inferior to broadcast television in many cases due to implementation, weather, service outage, and installation issues. Digital cable and DBS services do provide improved picture quality; however, they are premium services and carry the higher costs of acquiring the suitable equipment, proper installation, and monthly and pay-per-view service fees. Certainly consumer expectations should be higher for these higher priced and widely glorified and advertised services than for free over-the-air broadcast television. For these reasons, any comparison of digital DBS service to analog broadcast television is not appropriate and does not serve the consumer in an honest fashion. Arguing for an increase in the Grade B signal intensity standard due to heightened viewer expectations assumes that increasing expectations from premium services will ratchet up the expectations from broadcast service. This is illogical or, at best, not proven.

2.) Receiver Noise Figure

In its comments, EchoStar claims that the modern receiver noise figure is worse, i.e., higher, than it was for systems built in the 1950s. This counter-intuitive conclusion is not in accord with most existing reports and appears to be based upon an improperly drawn conclusion from a single reference. In general, modern receiver noise figures are better than those of the 1950s and would support lowering the required Grade B signal strengths.

The receiver noise figure is a measure of the internal noise a receiver adds to a signal. The lower the noise figure, the smaller this added noise is. In 1977, the Commission's Office of Chief Engineer determined that the average noise figure for low VHF was 6 dB and for high VHF was 7 dB.[1] Another study several years later found an average UHF noise figure of about 9 dB.[2]

The noise figures of modern receivers are generally agreed to be several dB less than the receiver noise figures used for the current planning factors. Early television tuner technology utilized noisy low-cost tubes while today's sets use lower noise solid state components. As Bronwen Lindsay Jones of CableLabs stated in 1992, in a paper referenced by the Commission in the NOI, "[i]n the past two years [i.e., since 1990] television receivers have achieved *vast improvements*."[3]

The source upon which EchoStar based the conclusion that VHF receiver noise figures have worsened was a noise figure study prepared by J.B. O'Neal for the Commission's UHF Comparability Task Force.[4] O'Neal's report does not support EchoStar's claim that modern noise figures are degraded from those circa 1950 for two reasons:

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[1] Research & Standards Division Office of Chief Engineer, A Review of the Technical Planning Factors for VHF Television Service, FCC/OCE RS 77-01.

[2] Philip B. Gieseler *et al.*, Comparability for UHF Television: Final Report (Office of Plans and Policy Sept. 1980.)

[3] Bronwen Lindsay Jones, Subjective Assessment of Cable Impairments on Television Picture Quality, 1992 NCTA Technical Papers.

[4] J.B. O'Neal, Television Receiver Noise Figure Study, Mar. 1980.

First, the noise figures were measured for UHF channel 34 and thus do not represent VHF data.

Second, the O'Neal report states that the measured data represent tuning system noise figures, not receiver noise figures. The overall system impact of the tuning subsystem's noise contribution will be lowered by the product of the component gains between it and the receiver's front end. Thus there is less need to focus design considerations on lowering that subsystem's noise factor. Thus it is not surprising that these tuning system noise figures did not show as much improvement as the UHF Comparability Task Force ultimately found for receiver noise figures over their 1950s counterparts.

3.) Transmission Line Loss

In their comments, both SBCA and EchoStar state that the transmission line loss planning factor is outdated and needs to be revised. While it is true that 75 ohm coaxial cable has largely supplanted the use of 300 ohm twinlead for television antenna installations, it is not true that the loss associated with 75 ohm coaxial cable is higher compared to 300 ohm twinlead. This change in installation practice is due because coaxial cable is not affected by installation near metallic objects such as antenna masts, it is less affected by moisture, and it also allows better and more consistent terminations to be made, and these terminations are more mechanically stable and resistant to corrosion.

The current transmission line loss planning factors based on 50 feet of 300 ohm twinlead are 1 dB, 2 dB, and 5 dB for low VHF, high VHF, and UHF, respectively. As a representation of currently available coaxial cable, EchoStar and SBCA both quote performance figures for RG-59 cable; however, the industry standard and the recommendation of the UHF Comparability Final Report is RG-6 coaxial cable (Reference 2). Indeed, EchoStar itself specifies, for home satellite installations, that RG-6 cable be used to send its signals from the antenna-mounted downconverter to the household receiver, and EchoStar also supplies RG-6 cable in its installation kits. The coaxial cable specified for television antennas should

be of no less quality than specified by EchoStar for its antennas. The loss values for 50 feet of RG-6 cable are 0.9 dB for low VHF, 1.4 dB for high VHF, and 2.8 dB for UHF which compare very favorably with twinlead.[5]

Both EchoStar and SBCA both state that old, wet, or improperly installed cable may have greater loss than new cable. This is at best a diversion, since such losses primarily affect twinlead. In addition, twinlead is even more vulnerable than RG-6 to losses due to metallic objects nearby as well as to poor mechanical terminations and connections.

4.) Receiving Antenna Gain and Optimization

The current planning factors for receiving antenna gain are 6 dBd for low VHF, 6 dBd for high VHF, and 13 dBd for UHF. EchoStar and SBCA both are recommending changing these factors based on data for outdated antennas and because of the asserted use of combination VHF/UHF antennas, which they claim have less antenna gain.

A survey of current Winegard antenna products shows that the average antenna gain of its Chromstar combination antenna models is 7.0 dBd, 11.15 dBd, and 12.21 dBd, respectively, for low VHF, high VHF, and UHF channels. If single band UHF antennas are included, then the overall UHF average increases to 13 dBd.[6]

Based on these values it appears that the low and high VHF average gains are higher than provided for in the existing planning factors, the high VHF average gain substantially so, and the UHF average gain is the same. Certainly no decrease in gain is warranted in the planning factors for receiving antenna gain. Indeed, low VHF and UHF should be left alone; however, high VHF average gain should be substantially increased.

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[5] Davis RF Products, Comscope #5715 RG-6, 75 ohm, http://www.davisrf.com/ham1/coax.htm#attenuation; Winegard Amp & Accessories Catalog, Cable, RG-6, http://www.winegard.com/cable.html.

[6] Winegard Company, Chromstar 2000 VHF/UHF Antennas, http://www.winegard.com/offair1.html.

EchoStar and SBCA also stated that additional loss should be considered due to the use of "splitters" that are used for sharing a single antenna among several television receivers. While it is true that the average household most likely has more than one television receiver, and the use of splitters introduces signal losses, proper installation practice, especially in areas of marginal signal strength, dictates the use of an amplifier before the splitter to eliminate splitter loss. In any case, splitters are of no consideration in the determination of a Grade B signal level outdoors where a conventional antenna would be located.

It is also important to note that the receiving antenna should be pointed at the desired television transmitter to obtain the full benefit of antenna gain and interference discrimination. The half power beamwidth of a typical television antenna ranges from approximately 30 degrees to as much as 70 degrees depending on the channel and gain. The care that must be taken when installing these antennas is not excessive, and the antenna is somewhat tolerant to slight pointing errors due to the somewhat large beamwidths. This required pointing accuracy is considerably less than what must be taken when installing a satellite antenna. Where greater optimization is required, a rotor is typically used; indeed, rotors are widely and conventionally used in areas of weak signal strength. It is also important to point out that not all consumers will be required to utilize the largest, highest gain and optimally pointed antenna to receive an acceptable picture. Only those consumers in fringe areas would need to install an optimal system, and the consumer has a choice about how to optimize his system. With a satellite system, by contrast, all consumers are required to install the same antenna, which is sized for the most difficult coverage area, and it must be pointed with exacting accuracy or it will not work at all.

5.) Dipole Factor and Thermal Noise

In its comments, EchoStar considered the planning factors for thermal noise and the dipole factor separately. EchoStar argued that since the typical television system now operates at 75 ohms, vis-à-vis the 300 ohms used in the development of the original factors, the receiver thermal noise factor, N, expressed as

$$N = 20 \log (SQRT(kTRB))$$

should be lower. We show below that this change is negated by a corresponding opposite change in the dipole factor that EchoStar does not quantify.

EchoStar also argued that the dipole factor for UHF must be changed due to the geometric mean of the channels having changed from 645 MHz to 615 MHz due to the removal of Channels 70-83 from UHF service. We agree with this change to the dipole factor, although it is negligible, and will address it further below.

In brief, from EchoStar's comments it appears that the thermal noise will be "somewhat" reduced and changes in the dipole factor should be higher than the original factors by 3 dB, 6 dB, and 6 dB for VHF low, VHF high, and UHF, respectively. But note that EchoStar's comments list the dB *magnitude* of the factors, causing confusion. The original dipole factors were 3, −6, and −16, which, because the planning factors are a table of losses, need to be *subtracted* from the other planning factors and thus should appear in the table as −3, 6, and 16, not the 3, 6, and 16 listed in EchoStar's comments. Thus, EchoStar's recommendation is really to *lower* the dipole factors by about 6 dB in each band, and the effect of this change, because negative numbers are being subtracted, when considered separately, is to raise the Grade B signal intensity values by 6 dB in each band. Our analysis shows that, in fact, there is no net change in the Grade B values, since the changes EchoStar recommends for the dipole factor are fully negated by the thermal noise reductions that are listed by EchoStar as "somewhat" of a reduction.

We will first address the dipole factor consideration not mentioned by EchoStar that effectively negates any change due to the current 75 ohm system impedance.

EchoStar writes the dipole factor as $K_d = 20 \log (47.7/f)$, which assumes a matched load of 73.5 ohms. The original dipole factor had an extra term, SQRT(300/73.5), to account for transforming the impedance to 300 ohms. Actually, assuming matched loads, both the thermal

noise factor and the dipole factor can be written for an arbitrary system input impedance R as follows:

$$N = 20 \log (SQRT(kT(73.5)B) * SQRT(R/73.5))$$

$$K_d = 20 \log ((47.7/f) * SQRT(R/73.5))$$

Since thermal noise is added in the table of losses but the dipole factor is subtracted, any change in the receiver thermal noise factor due to a change in the system input impedance, such as from 300 to 75 ohms, is negated by a corresponding change in the dipole factor. In short, changing the system input impedance does not change the power available from the system.

Since the dipole factors will be recalculated below using 75 ohm impedance, the new receiver thermal noise factor is, for proper comparison:

$$N = 20 \log (SQRT(kT(75)B)) = 20 \log 1.122 \text{ dBu} = 1.0 \text{ dBu}$$

where, in the above calculation, kT(75)B = 1.38E-23 * 290 * 75 * 4.2E6 = 1.26E-12.

EchoStar points out that the dipole factor should also be changed in the UHF band to compensate for the geometric mean frequency having decreased from 645 MHz to 615 MHz (a 0.4 dB difference). This should make the new UHF dipole factor (at 75 ohms) be:

$$\text{For UHF, } K_d = 20 \log ((47.7/615) * SQRT(75/73.5)) = -22.1$$

The low VHF and high VHF dipole factors are (again at 75 ohms):

$$\text{For low VHF, } K_d = 20 \log ((47.7/69) * SQRT(75/73.5)) = -3.1$$

$$\text{For high VHF, } K_d = 20 \log ((47.7/194) * SQRT(75/73.5)) = -12.1$$

Thus, revised Grade B thermal noise and dipole factors compared to the originals, where $\Delta = K_d - N$, are:

	Old K_d	Old N	Old Δ	New K_d	New N	New Δ
Low VHF	3	7	-4	-3	1	-4
High VHF	-6	7	-13	-12	1	-13
UHF	-16	7	-23	-22	1	-23

As can be seen, while both factors have changed, the difference due to the different geometric mean in the UHF band is negligible and the ultimate impact of the two factors remains unchanged since the difference (Δ) in dB remains essentially the same.

6.) Urban Noise

Urban noise is generated by various man-made sources such as electrical power distribution lines, electric motors, industrial operations, automobile ignition systems, and consumer wireless devices. The urban noise level for *urban areas* is currently assumed to be 14 dB for low VHF, 7 dB for high VHF, and 0 dB for UHF, and this urban noise level is a factor in the Grade A signal intensity standard. However, in the outlying and near-fringe areas of concern for Grade B purposes, urban noise is considered to be 0 dB.

While, in some areas, there has been further urban development since the original noise levels were determined, there is no current measured data to show that the levels have in fact increased and, even if so, by how much. In addition, the Commission has examined the issue of urban noise and determined that the effects are significant only for low VHF frequencies.[7] Although it could be assumed that noise levels have increased based on the extent of urban development, there has also been an increased awareness of electrical and radio noise and its impact on consumer electronic devices and, with this awareness, a concomitant increase in attempts to

[7] Report and Order, FCC 75-636, Television and FM Field Strength Curves.

shield noise generators. Examples of this effort to reduce environmental noise include burying electrical power distribution lines in housing subdivisions and shielding automotive ignition systems to protect sensitive microprocessor controlled devices such as engine management and emissions monitoring systems, ABS braking control, airbag sensors, cellular telephones, and navigation systems utilizing GPS. Several recent studies, including the UHF Comparability Task Force (Reference 2), the Commission in its DTV proceedings, and the 1977 report by the Office of Chief Engineer (Reference 1) have all concluded that no action needed to be taken to account for environmental noise for Grade B purposes.

The FCC Technical Advisory Committee is currently engaged in examining man-made noise and its potential impact on wireless devices. This effort is currently on-going and no results are available yet. Until measured results of a study on urban noise are available, it cannot be assumed that the urban noise factor should be changed in the Grade B planning factors. Certainly, the use of the Grade A urban noise planning factors is not warranted or supported by any published efforts.

7.) Peak Visual Carrier to RMS Noise Ratio for Acceptable Picture Quality

In its comments, EchoStar speculates that the penetration of a variety of modern services and technologies such as cable, direct broadcast satellites, VCRs, and video games has taught consumers to expect a much higher picture quality today than in the 1950s. SBCA's comments indirectly support this position by mentioning that a number of commentators contend that viewer expectations are higher. However, the SBCA officially declined to recommend any change regarding viewer expectations due the lack of any scientifically valid study of the issue. SBCA obviously recognized that this issue has no intuitive resolution. Comparisons of viewer expectations must recognize the apples versus oranges nature of comparing <u>for fee</u> services with <u>free</u> counterparts.

In the 1951 *Third Notice*, the Commission determined that a signal-to-noise ("S/N") ratio of 30 dB would be necessary to provide an acceptable picture to the median observer.[8] This figure remains the accepted standard despite several subsequent investigations. For instance, TASO, based on an analysis of 38,000 observations made by nearly 200 observers, determined that the median observer found a picture with a S/N ratio of 27.5 dB to be of acceptable quality. A picture with a S/N ratio of 30 dB was found acceptable by 70% of the viewers. Thus, the Commission's theoretical determination of an appropriate S/N ratio actually exceeded the empirical confirmation by 2.5 dB. Because the Commission's intention was to provide for an acceptable quality picture for the *median* observer, the 30 dB S/N figure actually provides a margin of safety of more than 2 dB.

In 1977 and 1980, the Commission's staff reviewed the technical planning factors for NTSC purposes and maintained the 30 dB S/N ratio (References 1, 2). For instance, the UHF Comparability Task Force expressly stated that "[f]or a passable television picture, the signal-to-noise ratio required continues to be about 30 dB." Even the SBCA/Hatfield & Dawson Statement admits that the Task Force determined that the signal-to-noise ratio did not need to be revised.[9]

Additional confirmation that a S/N ratio of 30 dB remains appropriate comes from the International Telecommunication Union, Radiocommunication Sector ("ITU-R"). In Recommendation BT.654 (1986), the ITU-R states that the mid-opinion value for the S/N ratio, unweighted, of continuous random noise is 29 dB.[10] The ITU-R notes that its method is applicable to all 525-line systems. Although the mid-opinion value corresponds to the middle rating ("slightly annoying") on the ITU-R's five-point scale, this middle rating is approximately

[8] Television Broadcast Service, *Third Notice of Further Proposed Rule Making*, FCC 51-244, 16 Fed. Reg. 3072, 3080 (Appendix B) Apr. 7, 1951.

[9] Comments of the Satellite Broadcasting and Communications Association, ET Docket No. 00-90.

[10] International Telecommunication Union, Radiocommunication Sector, Subjective Quality of Television Pictures in Relation to the Main Impairments of the Analogue Composite Television Signal, Recommendation BT.654 1986.

equivalent to TASO's Grade 3. Obviously this 29 dB S/N ratio, currently recommended and issued three decades after the Commission established a 30 dB S/N ratio and TASO confirmed that a 27.5 dB S/N ratio results in an "acceptable" picture, strongly indicates that current viewers perceive noise pretty much the way they always have.

The Hatfield & Dawson Statement supporting SBCA's comments contains a few additional statements pertaining to this issue that should be clarified. Statements on pages 3 and 4 seem to confuse the 90% time variability requirement with a requirement to provide a picture acceptable to the 90th percentile. There are three statistics here, which may be stated as follows:

1. The Commission has defined an acceptable picture to be one that the median (50th percentile) observer finds acceptable.
2. Grade B service is defined as having this acceptable picture available over at least 50% of the locations.
3. "Available" is defined as being received at least 90% of the time.

The Commission has never associated the 90th percentile of viewers with the definition of picture acceptability, as implied at the top of page 4 in the Hatfield & Dawson Statement. The Commission's position rightfully remains that the 30 dB level should remain in place until a definitive study clearly indicates the need for a change.

8.) Ghosting and Multipath

In its comments, EchoStar advocated the inclusion of the ghosting phenomenon associated with multipath interference in the Grade B planning factors. EchoStar introduced a formulation to equate TASO and CCIR quality grades to impairments from multipath signal levels. While this formulation is supported by tests that related measured multipath ghosting signal levels to viewer tolerances, accurately predicting multipath signal levels for a specific household is an extremely difficult, if not impossible, problem. Using the EchoStar formulation would require that such predictions be made. This is really a moot

point, however, since technologies are available to actively suppress the impact of multipath interference. Thus, ghosting is not an appropriate issue to consider.

While it is possible to measure multipath signal magnitude, phase, and time delays (displacement) and relate them to a ghosting image on a television receiver, to model and predict them in a dynamic environment of individual receivers will be difficult, if not impossible. Multipath propagation to a specific location is highly individual in its sensitivity to small changes in numerous variables, many of which are additive. These variables include terrain, weather (rain, snow), receiving antenna height, antenna location, antenna discrimination (pointing angle), local obstacle location, size, geometry, reflection coefficient of potential reflectors, time of year for areas with deciduous trees, wind, and even moving vehicles and aircraft. In addition, even movement of the transmitting antenna in the wind will affect the phase of the desired and interfering signals. To keep track of even a subset of these variables for a target residence and consider the unlimited number of potential multipath reflectors and the reflection coefficients associated with them accurately seems an insurmountable task. EchoStar mentioned LULC classifications in its comments, but this data is far too coarse to model these variables. Even if all potential multipath reflectors could be located within the coincident beamwidths of the transmitter and receiving antennas, it would be impossible to accurately predict the likelihood of a ghosting problem at any particular location or residence with any confidence.

As mentioned, however, these problems are moot. Unlike reception problems associated with environmental phenomena such as urban noise or propagation losses, viewers can take personal action to minimize or eliminate multipath effects. Such actions could include moving the receiving antenna vertically or horizontally or rotating it away from the source of the interference, as well as utilizing a more directive (higher gain) antenna to better discriminate against the interfering multipath signal. In addition, technical solutions already exist to eliminate the impact of "ghosting" and multipath. Ghost canceling integrated

circuits are available from at least one manufacturer that can be used to eliminate the impact of "ghosting" on picture quality.[11]

These ghost cancelers utilize adaptive equalizers to eliminate the effects of time-shifted signals. The fact that this technology is not currently popular in the industry may be that consumers do not view ghosting as a large problem or have successfully solved the problem, hence receiver manufacturers have not offered it (even as an option) due to lack of need. If "ghosting" were a major problem, the implementation of existing technical solutions would minimize the impact, and television receiver manufacturers would offer it to consumers.

Any methodology required to incorporate the prediction of "ghosting" will not produce meaningful results and will unnecessarily complicate the determination of SHVIA eligibility. "Ghosting" has nothing to do with predicting whether a residence receives a signal of Grade B intensity, and it has no place in the determination of Grade B signal strength.

SUMMARY

In response to the Commission's request for information on potential modifications to the Grade B signal standard, not one valid issue has been raised which, after scrutiny, indicates that the standard should be raised. The issues examined here may be summarized as follows:

1. Consumer Expectations: Consumer expectations from modern services such as cable and satellite broadcast may arguably be higher, but these are premium, digital "for fee" services. These services cannot reasonably be compared with the "free" services of over-the-air analog broadcast television.

[11] Oren Semiconductor, OR43300 and 43200 Video Ghost Cancellers, http://www.oren.com/html/products.html.

2. Receiver Noise Figure: The noise figure is actually lower in modern receivers. If any change is made it should be to lower this factor and consequently the Grade B standard. Leaving it as is makes the current standard even more conservative.

3. Transmission Line Loss: While 75 ohm RG-6 coaxial cable has largely supplemented 300 ohm twinlead, the transmission line loss has not changed significantly (a 1 dB to 2 dB reduction for UHF). The principal change has been in the better environmental isolation and installation properties of the cable, not solely in attenuation characteristics.

4. Receiving Antenna Gain: Current antennas do not have less gain than earlier ones. In fact, many possess higher gains. Most notably, average gains for the high VHF band have increased 4 dB to 5 dB from the original planning factors. The use of splitters is not a valid reason for changes since in areas of marginal signal strength amplifiers will be used. Finally, with half power beamwidths of 30 degrees to 70 degrees, pointing errors are not a major problem, but, to the extent an antenna needs to be optimally oriented, rotors are typically used in outlying areas.

5. Dipole Factor and Thermal Noise: It has been shown that changes in these factors due to the current use of 75 ohm receivers offset one another. The slight change in the UHF geometric mean frequency has a negligible impact.

6. Urban Noise: While some have found it tempting to surmise that urban noise has increased over the years, there are no studies proving this. In addition, there does not appear to be any market developing to address such issues, supporting the conclusion that this is not recognized as a significant problem.

7. Peak Visual to RMS Noise Ratio for Acceptable Picture Quality: Several studies subsequent to the initial determination of this factor in 1951 have only confirmed that it remains conservative.

8. Ghosting and Multipath: While methodologies exist to relate multipath impairments to the S/N ratio, the amount of environmental detail required to properly predict ghosting in individual situations is impossibly impractical. This is a moot point, however, since the technology exists to virtually eliminate multipath interference via active components in the receiver.

In sum, there is no valid scientific evidence supporting any increase in the Grade B values. Instead, the best available evidence supports either maintenance of the currect values as a conservative approach or a reduction in the values as the most accurate approach.

IITRI
IIT RESEARCH INSTITUTE

Center for Electromagnetic Science

Declaration of Ross R. Sorci

I, Ross R. Sorci, hereby declare as follows:

1. I am Ross R. Sorci, Assistant Vice President, IIT Research Institute Center for Electromagnetic Science.

2. I prepared the accompanying Further Engineering Statement at the request of the ABC Television Affiliates Association, CBS Television Network Affiliates Association, Fox Television Affiliates Association, and NBC Television Affiliates Association (the "Network Affiliates") for use by the Network Affiliates in Joint Reply Comments filed in response to the *Notice of Inquiry*, ET Docket No. 00-90, released May 26, 2000, in the matter of Technical Standards for Determining Eligibility for Satellite-Delivered Network Signals Pursuant to the Satellite Home Viewer Improvement Act. I also assisted the Network Affiliates in the preparation of their Joint Reply Comments and have reviewed the technical materials contained therein.

3. Dr. James H. Cook assisted me in the preparation of the Further Engineering Statement.

4. IITRI's background and my and Dr. Cook's qualifications were set forth in the Declaration accompanying IITRI's initial Engineering Statement in this proceeding.

5. The accompanying Further Engineering Statement, as well as the technical materials contained in the Joint Reply Comments of the Network Affiliates, are true and correct to the best of my information, knowledge, and belief.

This the 11th day of July, 2000

Ross R. Sorci
Assistant Vice President
IITRI Center for Electromagnetic Science

Exhibit 2

VHF ANTENNA GAIN AVERAGES

	Category	List Price	Low VHF Average Gain	High VHF Average Gain
Channel Master				
Crossfire 3610	Deep Fringe	$124	5.8	11.4
Crossfire 3612	Near Fringe	$91	5.2	9.6
Channel Master Average			*5.5*	*10.5*
Winegard				
Prostar 5030	Far Metropolitan-Near Fringe		5.7	8.2
Prostar 5040	Suburban-Deepest Fringe		6.9	10.5
Winegard Average			*6.3*	*9.4*
Channel Master/Winegard Total Average			**5.9**	**9.9**

UHF ANTENNA GAIN AVERAGES

	Category	List Price	UHF Average Gain
Channel Master			
UHF 4251	Deepest Fringe	$100	15.6
UHF 4228	Deep Fringe		12.0
UHF 4248	Long Fringe	$45	11.5
Channel Master Total Average			*13.0*
Winegard			
Chromstar 9095	Far Suburban-Near Fringe	$121	14.5
Prostar 9032	Near Fringe	$59	14.6
Winegard Total Average			*14.6*
Channel Master/Winegard Total Average			**13.6**

COMBINATION VHF/UHF ANTENNA GAIN AVERAGES

	Category	List Price	Low VHF Average Gain	High VHF Average Gain	UHF Average Gain
Channel Master					
Quantum 1160	Deepest Fringe	$160	5.8	10.1	9.0
Quantum 1162	Fringe-Deep Fringe	$118	3.9	8.0	8.5
Crossfire 3671	Deep Fringe-Deepest Fringe	$156	5.6	10.9	10.0
Crossfire 3678	Near Fringe-Deep Fringe	$120	4.7	9.6	9.6
Crossfire 3679	Far Suburban-Deep Fringe	$92	4.0	8.7	9.5
Channel King 3650	Deep Fringe	(economy line)	5.1	9.9	9.9
Channel King 3649	Fringe	(economy line)	4.3	8.2	8.6
Advantage 3020	Deep Fringe	$82	3.6	8.8	9.5
Advantage 3019	Fringe	$69	2.9	8.2	9.2
Advantage 3018	Near Fringe	$52	2.3	8.2	8.4
Channel Master Average			*4.2*	*9.1*	*9.2*
Winegard					
Chromstar 8200	Deepest Fringe		7.7	11.5	13.3
Chromstar 8100	Fringe-Deepest Fringe		7.9	11.8	12.5
Chromstar 8098	Fringe-Deepest Fringe	$202	7.5	11.1	11.1
Chromstar 7084	Near Fringe-Deep Fringe	$184	7.0	11.2	12.2
Chromstar 7082	Near Fringe-Deep Fringe		6.3	10.3	12.0
Chromstar 7080	Far Suburban-Near Fringe	$117	4.3	9.1	11.1
Prostar 7052	Deep Fringe	$141	6.3	10.2	12.4
Prostar 7037	Near Fringe	$105	5.4	8.9	10.9
Winegard Average			*6.6*	*10.5*	*11.9*
Channel Master/Winegard Total Average			**5.3**	**9.7**	**10.4**