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

In the Matter of	)	
	)	
Technical Standards for Determining Eligibility	)	
For Satellite-Delivered Network Signals Pursuant	)	ET Docket No. 00-90
To the Satellite Home Viewer Improvement Act	)	

REPORT

Adopted: November 29, 2000 **Released: November 29, 2000**

By the Commission:

1. As required by the Satellite Home Viewer Improvement Act of 1999 (*SHVIA*),[1] we are providing this Report to Congress on our evaluation of whether the signal intensity standard used to determine the eligibility of satellite television subscribers to receive retransmitted distant signals of network stations (hereinafter, "the distant network signal eligibility standard") should be modified or replaced. The Satellite Home Viewer Act (*SHVA*),[2] enacted in 1988, provides that only those satellite subscribers who cannot receive an acceptable signal over-the-air from a local network affiliate may receive a "distant" network signal. The existing standard uses the Grade B signal intensity values that have long been used within the television broadcast service for determining station service area contours.[3] In the Notice of Inquiry (*NOI*) in this proceeding, we sought information and comment on all technical parameters that scientifically could be considered to affect the quality of over-the-air reception of television pictures.[4] We also sought information and comment on an appropriate eligibility standard for digital signals. We stressed that we were not considering alteration of the Grade B standard for any purpose other than determining eligibility to receive retransmitted distant network signals.[5] In response to the *NOI*, eight comments and six reply comments were filed in the proceeding.[6]

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[1] Satellite Home Viewer Improvement Act of 1999, Pub.L. No. 106-113, 113 Stat. 1501, 1501A-526 to 1501A-545 (Nov. 29, 1999). Section 1008(a) of *SHVIA* added, *inter alia*, new Section 339 ("Carriage of Distant Television Stations by Satellite Carriers") to the Commission's statutory charter, the Communications Act of 1934, 47 U.S.C. § 151 *et seq*.

[2] The *SHVA* is part of the Copyright Act, 17 U.S.C. § 119. The *SHVIA* amended and replaced the *SHVA*.

[3] *See* Section 73.683 of the Commission's Rules, 47 CFR § 73.683.

[4] *See Notice of Inquiry*, ET Docket No. 00-90, FCC 00-184, released May 26, 2000 ("*NOI*").

[5] *NOI* at ¶ 1.

[6] See Appendix A for a list of commenters and reply commenters. Also, on July 17, 2000, J.E. Schmidt filed a request for extension of time to file comments and reply comments. Schmidt's request was filed five days after the reply period ended but he did not subsequently file any comments in this proceeding; therefore his extension request is hereby dismissed.

2. Based on the record, we recommend to the Congress that the Grade B signal intensity standard and eight of the nine planning factors used in that model be retained as the basis for predicting whether a household is eligible to receive retransmitted distant TV network signals under *SHVIA*. We recommend modification of the remaining planning factor, *i.e.*, time fading, by replacing its existing fixed values with location-dependent values determined for the actual receiving locations using the Individual Location Longley-Rice prediction model. We also find that it would be premature to construct a distant network signal eligibility standard for DTV signals at this time. We therefore recommend that establishment of a distant network signal eligibility standard for DTV signals be deferred until such time as more substantial DTV penetration is achieved and more experience is gained with DTV operation.

BACKGROUND

3. Broadcast television stations have rights, through the Copyright Act[7] and private contracts, to control the distribution of the national and local programming that they transmit.[8] In 1988, Congress adopted the Satellite Home Viewer Act (*SHVA*) as an amendment to the Copyright Act in order to protect the broadcasters' interests in their programming while simultaneously enabling satellite carriers to provide broadcast programming to those satellite subscribers who are unable to obtain broadcast network programming over the air. Under the *SHVA*, these subscribers were generally considered to be "unserved" by their local stations. Pursuant to the requirements of this statute, which linked the definition of "unserved households" to a Commission-defined measure of television signal strength known as "Grade B intensity,"[9] the Commission adopted rules for determining whether a household is able to receive a television signal of this strength.[10] In particular, the Commission adopted rules establishing a standardized method for measuring the strength of television signals at individual locations and endorsing a method for predicting the strength of such signals that could be used in place of actually taking measurements.[11] For Digital Television (DTV) stations, the counterpart to the Grade B signal intensities for analog television stations are the values in Section 73.622(e) of the Commission's Rules describing the DTV noise-limited service contour.[12]

4. *Grade B Contours and Signal Intensity*. The Grade B signal intensity standard, which is the key to the *SHVA's* definition of "unserved households" in Section 119(d)(10)(A), is a measure of the strength of a given television station's over-the-air signal.[13] This standard was developed in the early days of television as a key component of the Commission's channel allotment protocol.[14] Generally, if a

[7] 17 U.S.C. § 119. The Satellite Home Viewer Act is part of this copyright statute.

[8] *Satellite Delivery of Network Signals to Unserved Households for Purposes of the Satellite Home Viewer Act*, CS Docket No. 98-201, *Report and Order*, 14 FCC Rcd 2654 at ¶ 2 (1999) ("*SHVA Report and Order*").

[9] *See* 17 U.S.C. § 119(d)(10)(A); 47 CFR § 73.683(a).

[10] *SHVA Report and Order*, 14 FCC Rcd 2654 at ¶ 4.

[11] *Id.* at ¶ 8.

[12] 47 CFR § 73.622(e). *See also* 47 CFR § 73.625(b) (determining coverage).

[13] 17 U.S.C. § 119(d)(10)(A); 47 CFR § 76.683.

[14] *See* Television Broadcast Service, *Third Notice of Further Proposed Rule Making*, Appendix B, 16 Fed. Reg. 3072, 3080 (April 7, 1951) ("TV Allocations *Third Notice*"), *adopted by* Amendment of Section 3.606 of the (continued….)

household receives a television signal of Grade B intensity, it should receive an acceptable television picture at least 90% of the time.[15] More specifically, Grade B represents a field strength that is strong enough, in the absence of man-made noise or interference from other stations, to provide at least 90% of the time a television picture that the median observer would classify as "acceptable" using a receiving installation (antenna, transmission line, and receiver) typical of outlying or near-fringe areas.[16] The Grade B signal contour describes a boundary around a television station's transmitter.

5. The Grade B contours (which represent the required field strength in dB above one micro-volt per meter, or dB/μv/m) are defined in Section 73.683 of the Commission's rules for each television channel, as follows:

Channels 2-6 .... 47 dB/μv/m
Channels 7-13 .... 56 dB/μv/m
Channels 14-69 .... 64 dB/μv/m

Section 73.684 sets forth the Commission's methodology for predicting a TV station's Grade B service area coverage.[17] Section 73.686 describes a procedure for making field strength measurements.[18]

6. A signal of Grade B intensity is defined as a discrete value measured in units of dB/μv/m. However, the absolute intensity of broadcast signals at particular locations and at particular times cannot be precisely determined through predictive means, regardless of the predictive method used. Signal strength varies randomly over location and time, so signal propagation must be considered on a statistical basis. This is true regardless of whether the signal intensity is predicted at a fixed location (such as an individual household) or over an area. Some prediction methods, including the Commission's field strength charts (propagation curves), predict the occurrence of median signal strengths (*i.e.*, signal strengths predicted to be exceeded at 50% of the locations in a particular area at least 50% of the time).[19] Under this approach, "location" and "time" variability factors are added to the signal level for an acceptable picture so that the desired statistical reliability is achieved. The values chosen for the Grade B signal intensity standards account for this variability and, therefore, as indicated above, predict that at least 50% of the

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Commission's Rules and Regulations, Amendment of the Commission's Rule, Regulations and Engineering Standards Concerning the Television Broadcast Service, Utilization of Frequencies in the Band 470 to 890 mcs for Television Broadcasting, *Sixth Report and Order*, 41 FCC 148, FCC 52-294 (1952) ("TV Allocations *Sixth Report and Order*").

[15] *See* O'Connor, Robert A., "Understanding Television's Grade A and Grade B Service Contours," IEEE Transactions on Broadcasting at 139 (December 1968) ("O'Connor, *Understanding Television's Grade A and Grade B Service Contours*").

[16] The "median observer" is not the "average" observer; rather, it is the observer who provides the middle value of data when all values of data from all observers are ranked in order. In other words, 50% of the observers recorded values equal to or higher in value and 50% of the observers recorded values equal to or lower in value than the median observer. *See* TV Allocations *Third Notice*, 16 Fed. Reg. 3072, 3080 and TV *Allocations Sixth Report and Order*, 41 FCC 148.

[17] 47 CFR § 73.684.

[18] 47 CFR § 73.686.

[19] The Commission's field strength charts are set forth in Section 73.699 of the Rules, 47 CFR § 73.699.

locations along the Grade B contour will receive an acceptable picture 90% of the time.[20]

7. The "acceptable quality" contemplated when the Grade B standards were developed was based on picture quality levels used by the Television Allocation Study Organization ("TASO").[21] TASO used data from actual viewers. These viewers were shown television pictures and were asked to rate them on a scale from 1 (excellent) to 6 (unusable). Level 3, on which the Grade B service level was based, was defined as "(Passable) - The picture is of acceptable quality. Interference is not objectionable."[22] Based on the results of viewer ratings, a specific signal- (or carrier-) to-noise (S/N) ratio at the television receiver was found to correspond with the level 3 picture grade for each of the three television channel bands. That is, a specific level of signal corresponded to a picture quality that the median observer identified as acceptable. Given this correspondence, and with the primary goal of creating service areas with minimal interference and maximum coverage, the Commission developed certain assumptions, generally described as planning factors, regarding the environment in which "acceptable" viewing would take place.[23]

8. *Use of Grade B.* The Commission's rules use values for Grade B signal intensity in connection with the authorization of television stations and the determination of stations' service areas or "contours."[24] This measure was not, however, created or intended for evaluating service quality in individual households. Rather, it was developed to address the problem of defining station service areas and to determine the proper allotments for television channels, especially in the early days of television. The Commission created two "grades of service."[25] *Grade A* service connotes that "a quality [of service] acceptable to the median observer is expected to be available for at least 90 percent of the time at the best 70 percent of receiver locations at the outer limits of [the service area]."[26] For *Grade B* service, acceptable service is expected 90 percent of the time at 50 percent of the locations. These service definitions were

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[20] The "time variability" planning factor used in the determination of the Grade B standard may be a source of some confusion. In the TV Allocations *Sixth Report and Order*, 41 FCC at 177, the Commission adopted the initial television station allocation rules and stated, "in the case of Grade B service the figures are 90 percent of the time and 50 percent of the locations." *See also* TV Allocations *Third Notice*, 16 Fed. Reg. 3072, Appendices A and B. In CS Docket No. 98-201, *supra* note 8, both the broadcast and satellite parties stated the time variability factor differently than above. They described the field strength at the Grade B contour as being available to at least 50% of the locations at least 50% of the time. This apparent inconsistency arises from an adjustment the Commission adopted for the Grade B signal strength values when it originally established them. This adjustment results in a Grade B value that predicts reception of an acceptable picture 90% of the time. For example, on channels 2-6, a signal strength of 41 dB/μv/m is needed for an acceptable picture. In order for this signal strength to be available 90% of the time, the median or F(50,50) field strength is set at 47 dB/μv/m, which includes the addition of a time variability planning factor of 6 dB.

[21] See Engineering Aspects of Television Allocation, Report of the Television Allocations Study Organization, March 16, 1959.

[22] See O'Connor, *supra* note 15. The interference referred to here was from random noise.

[23] Assumptions were made as to the quality of the television receiver used; the signal losses that take place in the wire connection from the receiver to the antenna; the gain of the antenna to be used; the amount of electrical noise in the environment that the signal would have to overcome to be viewable; and the variability of radio signal propagation.

[24] *See* Section 73.683(a) of the Commission's Rules, 47 CFR § 73.683(a).

[25] TV Allocations *Third Notice, supra* note 14, 16 Fed. Reg. at 3075.

[26] *Id.*

established to effectuate the Commission's stated twofold purpose "to provide television service, as far as possible, to all people of the United States and to provide a fair, efficient and equitable distribution of television broadcast stations to the several states and communities."[27] The signal intensity values (also referred to as "field strengths") were determined based on specific assumptions for the planning factors that describe the receiving environment. These assumptions differ for the Grade A service area, typically urban and suburban, and the Grade B service area, which includes rural areas. For example, the type of receiving antenna assumed for Grade A service is smaller than the receiving antenna assumed for Grade B, and the definition of Grade A service takes into consideration man-made urban electrical noise.[28]

9. The recently enacted *SHVIA* revised and replaced the statutory provisions of the *SHVA*. With regard to the signal standard used for satellite carrier purposes, the *SHVIA* added a new Section 339(c)(1) to the Communications Act of 1934, as amended.[29] Pursuant to this section, we were directed to inquire into, and to evaluate, all possible standards and factors for determining eligibility for reception of retransmissions of network station signals. If appropriate, we are to recommend modification, or alternative standards or factors, to the Grade B intensity standard for analog television signals set forth in 47 CFR § 73.683(a), and to make a further recommendation relating to an appropriate standard for digital television signals. Thus, on May 22, 2000, the Commission adopted the *NOI* in this proceeding 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 *NOI* sought information and comment on all technical parameters that scientifically could be considered to affect the quality of over-the-air reception of television pictures. It also sought information and comment on an appropriate eligibility standard for digital signals. Our goal in this inquiry is to identify more accurately, and consistent with the *SHVIA*, those consumers who can and cannot receive their local television network stations over the air.

DISCUSSION

10. In the *NOI*, we specifically requested commenters who support replacement or modification of the Grade B eligibility standard or adoption of an eligibility standard for DTV to substantiate their comments with an engineering study based on persuasive scientific data.[30] In addition, we invited the submission of evidence documenting any significant changes in the TV reception environment that have not been documented in previous Commission proceedings. A clear consensus of comments proposed deferring adoption of an eligibility standard for DTV signals, because adoption of a standard at this time would be

[27] *Id. See* Section 307(b) of the Communications Act, 47 U.S.C. § 307(b).

[28] 16 Fed. Reg. at 3080. The receiving antenna assumed in the planning factors for Grade A is a half-wave dipole antenna for VHF and a 8 dB gain antenna for UHF, but for Grade B it is a directional antenna with 6 dB gain for VHF and 13 dB gain for UHF.

[29] Section 339(c) addresses the standards for DBS subscribers to be eligible to receive retransmission of distant TV station signals. Of particular note, Section 339(c)(1) requires the Commission to conduct "an inquiry to evaluate all possible standards and factors for determining eligibility for [satellite] retransmissions of the signals of network stations." This section further provides that the Commission is to "if appropriate -- (A) recommend modifications to the Grade B intensity standard for analog signals set forth in [47 CFR § 73.683(a)], or recommend alternative standards or factors for purposes of determining such eligibility; and (B) make a further recommendation relating to an appropriate standard for digital signals."

[30] *See NOI* at ¶¶ 9, 11, 14, 15, 17, 22, 24, 26, 27, 28, and 30.

premature. Also, the comments generally did not propose or support outright replacement of the method used to develop the existing eligibility standard for analog television signals, which is based on the Grade B signal intensity standard. Instead, satellite industry commenters generally proposed modifications to the planning factors used to develop the Grade B signal intensity values, based on their claims that changes in technology, demographics, and viewer expectations of picture quality have rendered the existing values obsolete.[31] Their proposed modifications would result in increases in the overall signal intensity values used to determine household eligibility for reception of distant network television signals so that more households would be deemed not to have an acceptable signal and thus be eligible to receive distant network service. On the other hand, broadcast industry commenters proposed retention of the signal intensity values currently used in the eligibility standard.[32] They state that improvements in technology could support a decrease in the overall Grade B signal intensity values, but that it is preferable to retain the existing values, which will provide households with a "safety margin" providing greater assurance that they will receive pictures of acceptable quality. The Grade B planning factors are shown in the table below.

[31] EchoStar Comments at 2 (urging Commission to recommend "several necessary modifications to the Grade B signal intensity standard") & *passim*; SBCA Comments at 2-7 & 9 (Commission should recommend updated Grade B signal strength values for *SHVIA* purposes). *Compare* NRTC Comments at 2 & 4-7 (Commission should recommend new standard to replace outdated and inadequate Grade B standard) *with* NRTC Reply Comments at 5 (Commission should recommend a revised Grade B standard sufficient to ensure that over-the-air TV picture quality is at least equal to that provided by satellite carriers).

[32] Joint Comments of ABC, CBS, Fox, and NBC Television Network Affiliate Associations ("Network Affiliate Joint Comments") at 20 (existing Grade B planning factors are still accurate today; if the Grade B eligibility standard is to be revised at all, it should be adjusted downward); NAB Comments at 58 ("[T]here is no basis . . . to revise the definition of 'Grade B intensity' based on technological or environmental changes since the 1950s. If anything, those changes . . . would warrant a decrease, not an increase, in the dBu's defined as 'Grade B.'"); Fox TV Comments at 3-4 (despite dramatic improvements, "Fox maintains that the Commission should not recommend any change to the current standard, but should allow consumers to continue to benefit from equipment refinements"); and MSTV Comments at 13-15 (existing planning factors continue to reflect quality service for the average TV receiver and should be retained; to the extent viewer expectations may have increased, resulting in demand for higher quality pictures, the noise levels of TV receivers have dramatically fallen well below the levels assumed by TASO in the 1950s and, thus, the existing Grade B eligibility standard remains appropriate). *See also* Biby Comments at 2 (Grade B remains a good predictor of gross signal strength; it is other factors, such as multi-path reception, urban noise, and interference that are the dominant reasons for unacceptable picture quality).

Table 1. Grade B Planning Factors

Factors	Units	Channels 2-6	Channels 7-13	Channels 14-69
1. Thermal Noise @ 300 ohms	dB/1μv	7	7	7
2. Receiver Noise Figure	dB	12	12	15
3. Peak Visual Car./rms Noise	dB	30	30	30
4. Transmission line loss	dB	1	2	5
5. Receiving Ant. Gain	dB	6	6	13
6. Dipole Factor	dB	-3	6	16
7. Local Field	dB/1μv/m	41	51	60
8. Terrain Factor (50%)	dB	0	0	0
9. Time Fading Factor (90%)	dB	6	5	4
10. Median Field F(50,50)	dB/1μv/m	47	56	64
11. To overcome Urban Noise	dB	0	0	0
12. Required Median Field	dB/1μv/m	47	56	64

We now turn to a discussion of each of these planning factors to which commenters offered specific modifications.

11. *Receiver Noise Figure.* The receiver noise figure is a measure of the amount of electronic noise produced by the components in the television set. An appropriate allowance for this receiver noise, as well as an allowance for man-made noise, must be included in the planning factors shown in table 1. The choice of an adequate signal budget (planning factors) that accounts for the overall noise level that must be overcome is necessary in designing TV sets. In the *NOI*, we pointed out that, since the 1950s when low cost electronic technology for television frequencies was not commonly available, TV tuner technology has progressed dramatically and tuners now contain modern solid state components that produce lower set noise. We therefore asked for comment on whether the television receiver noise figures long used as a Grade B planning factor are still valid for the average television receiver employed in the home today.[33]

12. EchoStar is the only commenter that claims that receiver noise figures have worsened since the 1950s.[34] In support of its position, EchoStar cites a study by J.B. O'Neal, Jr. that was submitted to the Commission in 1980 as part of the UHF Comparability Task Force, as "suggesting that the typical VHF television receiver noise figures have actually degraded by over 4 dB."[35] EchoStar argues that the receiver noise figures used as a Grade B planning factor, and currently set at 12 dB for VHF Channels 2-6 and 7-13, should be revised to 8 dB for Channels 2-6 and 13 dB for Channels 7-13.[36] SBCA, however,

[33] *NOI* at ¶¶ 13-14.

[34] EchoStar Comments at 7-8.

[35] EchoStar Comments at 8 & n.15, citing O'Neal Jr., J.B., "Television Receiver Noise Figure Study," March 1980.

[36] EchoStar Comments at 17 (table). EchoStar proposes that the existing 15 dB UHF receiver noise figure remain unchanged. We observe that, though EchoStar's suggested 13 dB figure for receiver noise in VHF (continued….)

"recommends a reduction for the receiver noise figure, because improvements in receiver technology have reduced noise at the receiver inputs."[37] Based on data taken from a 1979 Commission staff report on UHF comparability, SBCA's engineering statement indicates that the receiver noise figures should be revised to fall within the range of 6-12 dB for low VHF channels, 7-12 dB for high VHF channels, and 12-14 dB for UHF channels.[38] SBCA recommends application of the "highest values" in revising the Grade B values to develop a modified eligibility standard.[39] All other commenters that specifically addressed this planning factor indicated that receiver noise has improved and that, therefore, no increase in any of the receiver noise figures was warranted.[40] These parties generally state that if any adjustments were to be made in the receiver noise figures, they should be in the downward direction.

13. We find that the record supports maintaining the existing receiver noise figures used as a planning factor for the Grade B standard. We find no merit in EchoStar's argument that the noise figures should be revised upward. The record is barren of new scientific data that the Commission has not considered in the past. For instance, the O'Neal study and the UHF Comparability Report, relied on by EchoStar, are twenty years old. Neither purported to be a comprehensive study of receiver noise figures across all TV bands and receiver models. As the Network Affiliates point out, the UHF Comparability Task Force considered UHF receiver noise bands for some 200 TV receiver models that met the Commission's 14 dB maximum receiver noise figure and determined, for this grouping of receivers, that the average UHF noise figure was about 9 dB.[41] This result does not support EchoStar's claim that receiver

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Channels 7-13 represents a 1 dB degradation from the existing 12 dB figure, its suggested 8 dB receiver noise figure for VHF Channels 2-6 represents a 4 dB *improvement* from the existing 12 dB figure for those channels.

[37] SBCA Comments at 6.

[38] SBCA Comments at 6 & n.16 and Engineering Statement at Appendix 2, citing UHF Comparability Task Force, Office of Plans and Policy, Federal Communications Commission, *Staff Report on Comparability for UHF Television, A Preliminary Analysis,* at Tables B-1 and B-2 (Sept. 1979) ("UHF Comparability Report").

[39] SBCA Comments at 3. We observe that the net effect of SBCA's recommendation would be to leave unchanged the existing 12 dB receiver noise figure for all VHF channels and to improve the existing 15 dB figure for UHF channels by 1 dB, resulting in a 14 dB figure.

[40] Joint Comments of ABC, CBS, Fox, and NBC Television Network Affiliate Associations ("Network Affiliate Joint Comments"), Attached Engineering Statement at 7 ("[t]he noise figures of modern receivers are several dB less than the receiver noise figures used for the current planning factors"); NAB Comments at 43 (actual receiver noise figures are no greater than the 6/7/12 dB figures for low VHF / high VHF / UHF channels, respectively) and at 58 ("[T]here is no basis . . . to revise the definition of 'Grade B intensity' based on technological or environmental changes since the 1950s. If anything, those changes – including the great reduction in receiver noise – would warrant a decrease, not an increase, in the dBu's defined as 'Grade B.'"); Fox TV Comments at 3-4 (despite dramatic improvements in receiver noise figures over the years, "Fox maintains that the Commission should not recommend any change to the current standard, but should allow consumers to continue to benefit from equipment refinements"); and MSTV Comments at 13-15 (existing planning factors continue to reflect quality service for the average TV receiver and should be retained; to the extent viewer expectations may have increased, resulting in demand for higher quality pictures, the noise levels of TV receivers have dramatically fallen well below the levels assumed by TASO in the 1950s and, thus, the existing Grade B eligibility standard remains appropriate). *See also* Biby Comments at 2 (Grade B remains a good predictor of gross signal strength; it is other factors, such as multi-path reception, urban noise, and interference that are the dominant reasons for unacceptable picture quality).

[41] Joint Reply Comments of Network Affiliates ("Network Affiliates Joint Reply") at 5. *See also* MSTV Reply Comments at 4; and NAB Reply Comments at 6.

noise has worsened. Again as the Network Affiliates observe, the O'Neal study of 32 receivers measured noise figures at UHF Channel 34, and therefore is plainly inapposite to any consideration of VHF receiver noise.[42] Moreover, we cannot readily discern how EchoStar deduces its suggested revisions for the receiver noise figures from its assertion that "the typical VHF television receiver noise figures have actually degraded by over 4 dB."[43] In any event, the SBCA concession that receiver noise figures have improved, which supports the claim of the adverse broadcast interests, appears more credible and is consistent with the Commission's past observations that improvements in tuner technology have resulted in the mass manufacture of receivers that produce less internal noise.[44] As noted later in this Report, we believe that any investigation into changes in viewer picture quality acceptance should only be done in conjunction with a study of current television receiver noise figures. In any event, the current record does not contain any empirically developed data on contemporary television receivers from which we could recommend revision of the noise figures. In the absence of this data, we agree with the broadcast commenters that there is no reason to recommend any change in the existing receiver noise figures.

14. *Signal-to-Noise Ratio and Service Quality*. "Signal-to-Noise Ratio" is the ratio of the amplitude of the desired signal to the amplitude of the noise accompanying that signal. In an analog television receiver, a significant level of noise manifests itself in the viewed picture as what is commonly called "snow." The higher the signal-to-noise ratio, the less visible is snow. We recognize that, although the *NOI* in this proceeding stated that the signal-to-noise ratio was determined after detection inside the TV set, the TASO measurements most often cited as the source of the actual value were measured at the receiver terminals with a 6 MHz noise bandwidth. Therefore, hereafter in this Report, the signal-to-noise ratio will be deemed to be measured in the manner done by TASO. The existing planning factor for signal-to-noise ratio uses a value of 30 dB for all television bands.

15. In the *NOI*, we noted that comments submitted in the *SHVA Proceeding* had urged recognition that, for many people, the existing Grade B signal intensity values no longer equated to truly acceptable picture quality. In other words, the commenters had suggested that viewers' expectations as to what level of signal quality is "acceptable" had increased over time. If this were the case and the issue were an inadequate signal-to-noise ratio, a stronger signal or a receiver with a lower noise figure would be needed to produce a picture that would now be regarded as acceptable. Although there was some speculation in the comments filed in the *SHVA Proceeding* that viewer expectations had indeed changed,[45] we noted in the *NOI* that no current study documents this purported change or replicates the methodology of the initial TASO study that correlated viewer judgments of television picture quality with specific signal levels. We recognized that some research on subjective evaluations of television pictures might show that viewers have raised their level of expected performance, but stressed that the results of any subjective testing are

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[42] Network Affiliates Joint Reply at 7.

[43] *See supra* ¶ 12 & n.35.

[44] *See NOI* at ¶ 12.

[45] PrimeTime 24's consulting engineer, William Hassinger, pointed to two viewer studies, one by Neil Smith in 1971 and another conducted in Charlotte in 1996. See CS Docket No. 98-201, PrimeTime 24 Comments, Declaration of William Hassinger, Neil Smith Study ("Neil Smith Study"), and *ex parte* presentation of January 14, 1999. Neither study was conducted in accordance with the accepted standard for viewer studies, ITU Recommendation 500-4, *Methods for Subjective Assessment of Quality of Television Pictures*, Recommendations and Reports of the CCIR, Vol. XI, Part 1, Dubrovnik, 1986. Neil Smith acknowledged that his sample was too small to be sufficient for any generalizations. See Neil Smith Study at 18-19. The Charlotte study did not use study subjects from the general public, and its viewing conditions were not appropriate for a scientific study.

dependent on the testing methodology and conditions. For example, we cited several recent tests that were conducted by cable television sponsors using as subjects viewers who may have expected to receive, and to pay for, higher quality pictures.[46] We noted that those subjects, however, may not be representative of audiences relying on over-the-air reception for their television viewing. Thus, we explained, one of the specific purposes of this inquiry is to ascertain whether the signal intensity standard for *SHVIA* purposes needs to be updated to reflect consumers' current expectations of what is acceptable picture quality.[47] We pointed out that the results from an updated study of viewer expectations based on scientifically valid methods, such as ITU Recommendation 500-4,[48] could be valuable in this regard. Therefore, we requested information and comments on whether viewer expectations of acceptable television picture quality have changed and, if so, how any such changes should be accounted for in revising the Grade B standard for *SHVIA* purposes. For the purpose of developing a distant network signal eligibility standard, we asked for comment on whether we should expect television pictures received by over-the-air reception to be comparable to those received from satellite. We asked whether there have been any current studies made of today's home television viewer expectations of picture quality using scientifically valid subjective methods and, if so, for the results of these studies.

16. (a) *Signal-to-Noise Ratio*. EchoStar argues that consumers today demand a much higher quality picture than they did fifty years ago, and that consumers in the current television reception environment would view as "passable" only those TV signals having a much higher peak visual carrier-to-noise ratio than the 30 dB used as an existing Grade B planning factor.[49] EchoStar did not submit any technical study supporting its arguments, but instead simply points to the increased penetration of cable TV, DBS, VCRs, and video game systems, all of which, it claims, produce substantially noise- and interference-free pictures.[50] Nevertheless, the signal-to-noise ratio that EchoStar proposes, 30 dB for all TV channels, is identical to the ratio included as an existing Grade B planning factor.[51] EchoStar also urges the Commission to "recommend to Congress new factors based on statistically significant samples of modern viewers to take account of their changing expectations."[52] Another commenter, NRTC similarly avers that the television picture quality that today's viewers would grade as "acceptable" is superior to viewer expectations decades ago, when the TASO grading system was established. It attributes the success and growth of DBS and cable services in large part to the superior picture quality available from such non-broadcast distribution. NRTC states that picture quality is often cited as a very important factor in consumer decisions to subscribe to DBS services. NRTC acknowledges, however, that it is unaware of any current studies that indicate the precise degree to which viewer expectations have changed.[53] NRTC adds

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[46] See Charlotte study, *supra* note 45, and *Subjective Assessment of Cable Impairments on Television Picture Quality,* Bronwen Lindsay Jones, 1992 NCTA Technical Papers.

[47] *NOI* at ¶ 14 & n.29, citing Letter to Chairman, FCC from Senator McCain and Representatives Bliley, Oxley, and Markey, dated December 8, 1999.

[48] *See* Recommendation 500-4, *supra* note 45.

[49] EchoStar Comments at 8-9. Among other factors, EchoStar cites evolutionary shifts in consumer expectations as warranting a revision to the Grade B planning factors. EchoStar Reply at 7.

[50] *Id.* This statement was also submitted by EchoStar without any substantiating evidence.

[51] EchoStar Comments at 17 (table).

[52] EchoStar Comments at 4-5.

[53] NRTC Comments at 6.

in reply comments that, at minimum, the Commission should undertake a study to assess current viewer expectations.[54] It states that the current lack of reliable studies will only perpetuate the status quo under which millions of rural viewers remain unserved and ineligible to receive distant network signals. It continues that it is unrealistic to expect either the satellite industry or broadcasters to conduct scientifically valid, neutral tests to determine viewer expectations on their own initiative, and that this task is more appropriately conducted under the Commission's auspices. SBCA appears to agree that viewer expectations of picture quality have increased dramatically since the Grade B standard was adopted. It acknowledges that, at present, no such study exists and suggests that an updated, scientifically valid study of viewer expectations might be warranted.[55] SBCA states that, at this time, it "is not able to advise the Commission on how changes in viewer expectations should be accounted for in revising the Grade B signal standard or its underlying factors for purposes of *SHVIA*."[56] Nonetheless, it proposes a substantial increase in the signal-to-noise ratio planning factor.[57]

17. Fox states that there is no empirical evidence suggesting that viewer picture quality expectations have changed.[58] Absent a scientifically valid study showing significant change in viewer expectations, Fox argues that the Grade B standard should not be changed.[59] It opines that "continued satisfaction of viewers' expectations for picture quality is due in large part to technological advances in television receivers over the past decades," with receiver noise figures improving markedly.[60] Jules Cohen, in an engineering statement in support of NAB's reply comments, indicates that the higher signal-to-noise ratio advocated by SBCA is based on values that the Commission considered in relation to cable television systems, which deliver programs to paying subscribers.[61] In agreement, Network Affiliates comment that the Grade B planning factors are still accurate today.[62] Network Affiliates add that, without a scientifically valid study correlating viewer judgments of picture quality with specific signal levels, "any argument that viewers are dissatisfied with the quality of the picture resulting from a signal of Grade B intensity is pure conjecture."[63] In this regard, Network Affiliates stresses that the Bronwen Lindsay Jones study, cited by

[54] NRTC Reply at 4.

[55] SBCA Comments at 9.

[56] *Id.*

[57] SBCA Comments, Attached Engineering Statement at Appendix 2 (table).

[58] Fox Comments at 3.

[59] Fox Comments at 3-4.

[60] Fox Comments at 4.

[61] NAB Reply, Attached Engineering Statement at ¶ 9 ("that level was acknowledged by the Commission as being higher than the "acceptable" level applicable to free, over-the-air signal delivery. Although the 30 dB signal-to-noise standard was adopted in 1952, it is supported by later studies and no comprehensive study to date concludes that a different standard is required.").

[62] Network Affiliates Comments at 20.

[63] Network Affiliates Joint Comments at 14-15.

the *NOI*,[64] is inapplicable because: (a) its subjects were cable subscribers only, who may have expected to receive and to pay for higher quality pictures; (b) its results are fatally skewed because it employed an entirely different scale than the TASO study, and scale bias resulted from the exclusion of all signal-to-noise ratios below 36 dB; and (c) it employed only 33 subjects in comparison to the nearly 200 subjects (and 38,000 individual assessments) used by TASO, used weighted noise compared to TASO's use of unweighted noise, and used viewing distances closer than the 10-foot viewing distance used in the TASO study.[65]

18. SBCA claims that "a statistical factor for signal to noise ratio as it affects picture acceptability may be added to the FCC values, since the Commission assumed 30 dB, and the 90% acceptability value is known to be 34 dB."[66] On the other hand, Network Affiliates point out that the 30 dB figure was originally found by the Commission to be necessary to provide an acceptable picture to the median observer. It adds that TASO subsequently determined that a signal-to-noise ratio of 27.5 dB would be sufficient for this purpose, and that a ratio of 30 dB would assure that 70% of viewers would find the picture to be acceptable.[67] Network Affiliates therefore argue that the existing 30 dB figure already includes an extra margin of 2 dB and that no increase in this figure is warranted.[68] In its comments, NAB agrees with this assessment.[69]

19. We recognize that there is much confusion in the use of signal-to-noise ratio numbers when referring to the acceptability of video pictures. First of all, TASO in the 1950's measured signal to noise requirements for TV as the ratio of the root-mean-squared ("rms") RF signal during synchronizing peaks divided by the rms noise voltage over a 6 MHz channel. Part 76 of the rules (Cable Television) does not specifically set forth the noise bandwidth required in measuring the carrier-to-noise ratio ("C/N"). It is standard practice in the cable industry, however, to measure C/N with a signal analyzer using a noise power bandwidth of 4 MHz. A difference of approximately 2 dB between the two measurements results from the difference in noise power bandwidth (4 MHz versus 6 MHz) employed in the corresponding measurement techniques. Therefore, these different measurement techniques quite often result in the expression of the signal-to-ratio as different values when referring to the same picture quality. Secondly, differences or similarities in testing methodology are an issue that affects the consistency of grading the acceptability of video pictures. For instance, differences in the type of instructions given to the observers during testing, the type of observers (experts/non-experts), viewing distances, size and quality of television

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[64] *NOI* at ¶ 14 & n.28, citing Bronwen Lindsay Jones, *Subjective Assessment of Cable Impairments on Television Picture Quality*, 1992 NCTA Technical Papers, *supra* note 46.

[65] Network Affiliates Joint Comments at 15-17. *See also* NAB Comments, Attached Engineering Statement at ¶ 4.

[66] SBCA Comments, Attached Engineering Statement at 3. SBCA also proposes a 3-dB adjustment to account for splitter noise and another adjustment to account for increased man-made noise. We find, however, that it is more appropriate to address splitter noise as part of the "Transmission Line Loss" issue and to address man-made noise as part of the "Environmental Noise" issue, below.

[67] Network Affiliates Comments, Appended Engineering Comments at 6.

[68] *Id.* at 7 & 10-11.

[69] NAB Comments at 44 n.37. Though NAB states that the margin is 3 dB as compared to the 2 dB claimed by Network Affiliates, this inconsequential 1 dB difference is explained by a difference in rounding TASO's 27.5 dB figure (NAB rounds this figure to 27 dB, whereas Network Affiliates rounds up to 28 dB).

receivers, and types of pictures (still or motion) used during testing, as well as the dynamic range of signal levels used during testing can each influence the results.[70] In any reexamination of the signal-to-noise ratio values needed to represent the grade of over-the-air TV pictures that today's viewers would find "acceptable," these subjective testing parameters would have to be selected.[71]

20. We disagree with EchoStar that it was over-the-air television picture quality as affected by signal to noise ratio that was the major contributor to the increased penetration of cable TV, DBS, VCRs, and video game systems. We recognize that these video alternatives offered many other incentives such as more channels of programming, interactivity, and programming venues aimed at smaller audiences. In addition, there are other television picture impairments beyond signal to noise ratio, such as multipath discussed later in this report, that we believe may have been a greater contributor to any viewer dissatisfaction with over-the-air television reception. Based on the evidence collected in this inquiry and without scientific evidence of a change in the value of signal to noise ratio as subjectively determined by the median of viewer observation, we agree with Network Affiliates that there is no reason to believe that viewer perception with regard to the acceptability of random noise impairment has significantly changed.

21. Nevertheless, based on the evidence collected in this inquiry, there is one change to the signal-to-noise ratio that could be considered. Specifically, in determining distant network signal eligibility, one could choose to employ as a criterion those pictures that are graded as "acceptable" by some percentile of viewers higher than the median (50%) applied in the Grade B planning factors. In this regard, we note that SBCA has suggested that the signal-to-noise planning factor should, uniquely for *SHVIA* purposes, be modified to include an additional "statistical acceptability" factor to assure that 90% of all observers would view the picture as acceptable. (SBCA states that the modified value would be 34 dB). On the other hand, we must recognize that the current value of 30 dB is already 2.5 dB higher than the value found by TASO to represent an acceptable picture to at least 50 percent of viewers. Thus, we agree with Network Affiliates[72] that the current 30-dB value for the signal-to-noise ratio indicates statistically that the corresponding picture quality would be graded "acceptable" by at least 70 percent of the TASO viewers. We believe that in order to increase the percentile any further, it would be necessary to conduct a TASO-style study with a greater number of observers than the original TASO study employed, so that an appropriate statistical confidence level in the result would be retained.

22. Beyond the above possible adjustment to the signal-to-noise ratio based on picture acceptance by a higher percentage of viewers, we find no persuasive evidence in the record warranting any change in the existing signal-to-noise figure used as a Grade B planning factor. No new data has been presented that the Commission has not already considered in the past. The record does not contain any scientifically sound basis that infers that consumer expectations of picture quality have risen in a manner warranting any revision to the planning factors.[73] Also, we are skeptical that a Commission-initiated study of viewer

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[70] This issue is noted by Network Affiliates in their Joint Comments at 16-17.

[71] Most of these parameters for subjective testing are specified in the ITU-R, Recommendation BT.500-10 titled Methodology For The Subjective Assessment of The Quality of Television Pictures.

[72] Network Affiliates Joint Comments, Appended Engineering Statement at 6, Joint Reply at 9-10 & Exh. 1 (Further Engineering Statement) at 11.

[73] We note that Capitol has included the results from testing in 1990 of the signal strength of Station WDRB-TV, Louisville, Kentucky, and states the tests confirm the viability of the Grade B signal of that station in real-world conditions. Capitol Reply at 4 & Exh. 1.

expectations, as recommended by NRTC, would prove cost effective or worthwhile.[74] In fact, we trust that if viewer expectations were thought to have changed dramatically, marketplace forces would have led either the satellite industry or the broadcast industry to conduct its own extensive studies. As stated before, we believe that an exact replication of the TASO testing methodology and the use of the median of observations would not lead to the conclusion that the planning factor values should be raised significantly.[75] Moreover, we believe the real answer is that, as the broadcaster comments indicate, it is highly likely that technological advances have increased the picture quality actually provided over-the-air to consumers, and these advances provide a "margin of error" that would compensate for any actual increase in consumer expectations. Therefore, any re-examination of viewer acceptance of picture quality would have to be done in conjunction with a new study of current receiver performance or noise figures.

23. *(b) Picture comparability between paid video service and free over-the-air television service.* NRTC urges the Commission to recommend to Congress the establishment of a new distant network signal eligibility standard that will provide television picture quality at least equal to that provided by satellite carriers, so that viewers will be able to receive the best available picture quality, either over the air from local network affiliates or satellite retransmissions of distant network signals from a DBS provider.[76] On the other hand, Network Affiliates assert that the Commission should not conflate viewer expectations regarding the picture quality of a paid subscriber TV service, such as satellite or cable, with expectations regarding the quality from a free over-the-air signal. They argue that consumers who pay for service should expect to receive a picture quality that is better than what they receive for free.[77] Network Affiliates assert that the distinction between free, analog, over-the-air broadcast television and pay, digital satellite service is critical and must not be obliterated.[78] They submit that the viewer picture quality expectations for free and pay services are different and should remain so. Otherwise, Network Affiliates claim, the copyright protections that Congress wished local stations to maintain would effectively be eviscerated, the principle of localism imperiled, and the conversion to digital technology by terrestrial broadcasters severely set back.[79]

24. We observe that NRTC's assertion that free, over-the-air picture quality should be required to meet or exceed that provided by paid DBS or cable service appears to conflict with the statutory purpose of *SHVIA*. In this respect, we agree with the observations of NAB that in enacting the statute, Congress intended to preserve the overarching broadcast television principles of localism and copyright protection and therefore created only a narrow exception to allow for a "life-line" service to those homes that cannot

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[74] *See* NAB Comments at 5-26, Reply at 15 ("55% of U.S. television viewers already can watch their local network stations by satellite . . . and that number is constantly growing"); Network Affiliates Joint Comments at 12-13; Capitol Reply at 5-6 (increase of local signal carriage by satellites means fewer member of public, rather than greater number, are unable to receive their local TV station signals).

[75] See ¶ 19, *supra.*

[76] NRTC Comments at 6-7. *See also* NRTC Reply at 2, 3-4.

[77] Network Affiliates Joint Comments at 15 & Appended Engineering Comments at 8. *See also* MSTV Comments at 15 & n.41.

[78] Network Affiliates Joint Reply at 43 & Exh. 1 (Further Engineering Statement) at 2, 14. *See also* NAB Reply at 3.

[79] Network Affiliates Joint Reply at 43-45.

receive local network television stations off-the-air.[80] In this regard, Congressman Howard Coble, an original sponsor of *SHVIA*, stressed:[81]

> The existing provisions of the Satellite Home Viewer Act allow satellite carriers to retransmit copyrighted programming for a set fee to a narrowly defined category of customers. The Act thus represents an exception to the general principles of copyright – that those who create works of authorship enjoy exclusive rights in them, and are entitled to bargain in the marketplace to sell those rights. In almost all other areas of the television industry, those bedrock principles work well. Indeed, virtually all of the programming that we enjoy on both broadcast and nonbroadcast stations is produced under that free market regime. Because exclusive rights and marketplace bargaining are so fundamental to copyright law, we should depart from those principles only when necessary and only to the most limited possible degree. Statutory licenses represent a departure from these bedrock principles, and should be construed as narrowly as possible.
>
> Reflecting the need to keep such departures narrow, the existing Satellite Home Viewer Act permits network station signals to be retransmitted only to a narrowly defined group of "unserved households," *i.e.*, those located in places, almost always remote rural areas, in which over-the-air signals are simply too weak to be picked up with a correctly oriented, properly functioning conventional rooftop antenna. The definition of an "unserved household" continues to be the same as it is in the current statute, *i.e.*, a household that cannot receive, through the use of a properly working, stationary outdoor rooftop antenna that is pointed toward the transmitter, a signal of at least Grade B intensity as defined in Section 73.683(a) of the FCC's rules. . . .

Further support for this view, as NAB points out,[82] is provided by the *SHVIA* Conference Report, which stated that the:[83]

> Conference Committee is aware that in creating compulsory licenses . . . [it] 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. . . . [A]llowing the importation of distant or out-of-market network stations in derogation of the local stations' exclusive right – bought and paid for in market-negotiated arrangements – to show the works in question undermines those market arrangements.

The Conference Report also emphasized that "the specific goal of the [Section] 119 license, which is to allow for a life-line network television service to those homes beyond the reach of their local television stations, must be met by only distant network service to those homes which cannot receive the local network television stations. Hence, the 'unserved household' limitation that has been in the license since its inception."[84]

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[80] *See* NAB Comments at 6-24.

[81] 145 Cong. Rec. H12813 (daily ed. Nov. 18, 1999) (statement of Rep. Coble).

[82] NAB Comments at 16-17.

[83] 145 Cong. Rec. H11792 (daily ed. Nov. 9, 1999).

[84] *Id.*

25. Therefore, we find no evidence in the record that the intent of *SHVIA* is to promote or provide television picture quality comparability between paid video service and free over-the-air television service. We note that NRTC's recommendation for a study is predicated on its view that "viewer expectations have certainly changed . . . based on the unquestionable success and growth of DBS and cable services, which is due in large part to the superior picture quality available from such non-broadcast distribution. This higher picture quality has raised the bar for the entire broadcast, cable and satellite video delivery industry."[85] As we have explained, we do not agree with NRTC's predicate that viewers expect the same picture quality from a free, over-the-air service as from a paid subscription service such as DBS or cable. Consequently, we do not recommend any changes to the eligibility standard to achieve comparability between paid video service and over-the-air free television.

26. *Transmission Line Loss and Antenna Gain.* In the *NOI,* we explained that the original analog TV planning factors were developed for 300-ohm impedance systems using open twin lead cabling. On the plus side, these early systems had low attenuation of signal due to the connecting cabling and impedance transfer at both the antenna and receiver. On the negative side, the open twin line cabling was prone to pick up electrical noise and RF interference. Today, most antenna systems use 75-ohm coaxial cabling. Although these 75-ohm systems are more immune to electrical noise and RF interference pickup, their signals are more highly attenuated due to the connecting cabling.[86] We observed that an NTIA Report (81-68), published in 1981, evaluated a study of home TV UHF antenna installations located at 50 distinct sites between Chicago and Peoria, Illinois. The report concluded that the median antenna system gain for systems using a 75-ohm transmission line was lower than that for systems using a 300-ohm transmission line. In addition, the report found that, for the more modern 75-ohm transmission line installations, the median estimated antenna system gains, as classified by frequency and service area (Grade A or Grade B), were less than system gains that were applied as planning factors in defining required field strengths. Given the technical differences between the 300- and 75-ohm systems, we requested comment on whether the existing transmission line and antenna gain planning factors remain appropriate for today's analog television receivers. Because reception of satellite delivered television is generally based on the installation of a directional outdoor antenna, we also asked for comment on whether it is also appropriate to expect viewers to put forward a comparable effort to achieve adequate over-the-air terrestrial television reception. In particular, we requested comment on whether it is appropriate to assume that consumers would use an outdoor, directional gain antenna model for over-the-air reception of television when determining distant network signal eligibility. We also sought comment on whether there have been more current studies of typical home television receiving installations than the NTIA Report cited above and, if so, on their extensiveness and results. Finally, we pointed out that Section 1005(a) of *SHVIA* amended the Copyright Act to define a household as "unserved" with respect to a particular TV network if that household, *inter alia*, "cannot receive, through the use of a conventional**,** *stationary***,** outdoor rooftop receiving antenna, an over-the-air signal of a primary network station affiliated with that network of Grade B intensity."[87] We therefore sought comment and information as to the methodology that could be used to incorporate a stationary antenna model into the modification of the Grade B field intensity standard. The current Grade B standard assumes that the antenna is pointing toward the desired station, and as such, the maximum gain of the antenna provides a signal level at the receiver that will produce an acceptable picture quality. For the purpose of determining distant network signal eligibility, we sought comment on whether and how to modify the antenna gain planning factor for those network stations not in the center of the main beam of a

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[85] NRTC Reply at 4 (emphases added).

[86] *NOI* at ¶ 16.

[87] 17 U.S.C. § 119(d)(10)(A) as amended by *SHVIA* § 1005(a) (emphasis added).

stationary directional antenna. We asked for comment on which station location should be considered the pointing direction of the antenna when making such determinations.[88]

27. *(a) Transmission Line Loss: (i) Effect of System Impedance.* Satellite interests urge that the transmission line loss factor should be increased. The existing line loss factor is 1/2/5 dB for the low VHF / high VHF / UHF TV channels, respectively. EchoStar states that most modern TV receivers have an input impedance of 75 ohms, and most antenna transmission cables also have 75-ohm impedance. EchoStar cites two studies that compared the average transmission line losses of the older 300-ohm twinlead cables against those of 75-ohm RG-59 coaxial cables: for the 300-ohm cables, a 1974 study that found average transmission line losses in the low VHF, high VHF, and UHF TV band, respectively, to be 0.9, 1.5, and 2.3 dB; and a 1980 study that found these losses to be 0.8, 1.5, and 3.1 dB.[89] In comparison, the respective results from these studies for RG-59 cables were: 1.5, 2.4, and 4.6 dB; and 1.2, 2.3, and 4.5 dB. EchoStar adds that aged, wet, or improperly installed cables may have greater losses than do new, dry ones, and argues that contemporary receive antenna feedlines would be expected to have losses greater than predicted by the planning factors.[90] Ultimately, EchoStar recommends that the existing transmission line loss planning factor values of 1 and 2 dB, for the low- and high- VHF bands, remain unchanged, and that the respective value for the UHF band be increased by 1 dB (from the existing 5 dB to 6 dB).[91] SBCA likewise asserts that the transmission line loss planning factor needs to be updated, and suggests that the respective values be increased to 2, 3, and 6 dB for the respective TV bands.[92] Broadcast interests, by contrast, state that the line loss associated with 75-ohm cabling is the same or slightly better than that for 300-ohm twinleads, and that no change in the values for the transmission line loss planning factor is warranted. Network Affiliates, for example, note that twinlead cable is susceptible to degradation due to water, proximity to metal structures such as downspouts, and poor terminations, whereas currently available RG-6 coaxial cable is shielded and much less susceptible to attenuation changes and the connectors used with it provide more consistent terminations.[93] Network Affiliates state that the current

[88] We note that the *SHVIA* requires a determination of household eligibility for each network station considered individually. For example, a household could be served with respect to a NBC affiliate if the household could receive the NBC signal from any NBC affiliate at Grade B intensity with a stationary outdoor antenna. But the same household could be considered unserved with respect to the Fox network because it cannot receive any Fox affiliate's signal at Grade B intensity with a stationary outdoor antenna. Each network station's signal intensity must be independently considered.

[89] EchoStar Comments at 9-10, citing Rubin, Kessler, and Wilhelm, *A Quantitative Comparison of the Relative Performance of VHF and UHF Broadcast Systems,* CPB Technical Monograph No. 1, June 1974, at 27, and Free, Woody, and Daher, *Program to Improve UHF Television Reception,* prepared for the UHF Comparability Task Force by Georgia Institute of Technology, Project No. A-2475, September 1980, at 4-16 (reporting only data for TV channels up to 69). Also, citing FitzGerrel, Jennings, and Juroshek, *Television Receiving Antenna System Component Measurements,* NTIA Report 79-22, June 1979, at 33 & 36, EchoStar states that these data were similar to the results of testing new lines, that is, losses of 1.0, 1.8, and 3.2 dB, respectively. We observe that all of these results fall within the existing transmission line loss planning factor values for Grade B.

[90] EchoStar Comments at 11.

[91] EchoStar Comments at 17 (table).

[92] SBCA Comments at 4-5 & Appendix 2. We note that SBCA has not specified the type of 75-ohm cabling upon which its data and recommendation is based. SBCA also recommends a further 3 dB increase across all bands to account for splitter loss.

[93] Network Affiliates Joint Comments, Appended Engineering Comments at 6.

specifications for attenuation of 50 feet of RG-6 cable are 0.8-0.94 dB for low VHF, 1.3-1.4 dB for high VHF, and 2.2-2.9 dB for UHF, values which fall within the existing planning factor for Grade B. NAB agrees, pointing out that the specifications published by a leading manufacturer of antennas and cable (Winegard) for readily available RG-6 coaxial cable, the cable recommended by the UHF Comparability Report for use in downleads, are 0.7-0.95 dB (low VHF), 1.3-1.4 dB (high VHF), and 2.15-2.9 dB (UHF).[94]

28. We find that no change in the existing transmission loss planning factor values for Grade B is warranted. None of the comments have identified any more current studies that suggest a need to change this planning factor. The broadcast and satellite commenters diverge on the need to change the values for 75-ohm cabling based largely on their different assumptions of which type of cabling would be employed by consumers, *i.e.,* RG-6 (suggested by the broadcasters) or RG-59 (chosen by satellite interests). We agree with Network Affiliates that there 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, and that the transmission loss planning factor values for Grade B provide a conservative margin for this type of coaxial cable.[95] As Network Affiliates point out, the UHF Comparability Final Report, prepared in 1980, recommends the use of RG-6 cable,[96] a 1979 NTIA study found that, for the longer outdoor run (between the outdoor antenna and the wall outlet) RG-6 type coaxial cable would usually be used, whereas for the indoor short connection (between the wall outlet and the TV receiver) RG-59 coaxial cable is usually used,[97] EchoStar's own self-installation kit for home satellite TV receivers specifies the use of, and supplies, RG-6 cable,[98] and RG-6 coax cable is commonly available.[99] Finally, Network Affiliates state that, in determining the DTV downlead line loss planning factor, the Commission has assumed transmission line loss values that are no greater than those set forth in the existing analog Grade B transmission line loss under consideration here.[100] We agree with Network Affiliates' analysis of the

[94] NAB Comments at 50, citing www.winegard.com/cable.html.

[95] Network Affiliates Joint Reply at 15-18.

[96] *Id.* at 15 & nn. 54-55, citing Philip B. Geiseler *et al.,* Comparability for UHF Television: Final Report (Office of Plans and Policy Sept. 1980) ("UHF Comparability Final Report"), at 59-60 (RG-6 coax offers very good performance; an RG-6 system is a good value because the coaxial systems offer even less performance variability than shielded twin-lead; coax is much easier to manipulate than shielded twin-lead and presents fewer installation problems; and RG-6 is a good quality cable).

[97] Network Affiliates Joint Reply at 16 & 58, citing R.G. FitzGerrel *et al.,* Television Receiving Antenna System Component Measurements, NTIA Report 79-22 (June 1979), at 37. EchoStar also relied upon this NTIA report, *see supra* n.62. Network Affiliates also point out that the use of RG-59 cable for the indoor short connection (typically, 3 feet in length) would have only negligible impact on the overall attenuation of 50 feet of transmission line.

[98] Network Affiliates Joint Reply at 16 & nn. 59-60, citing Dish Network, *The Self Installation Kit from DISH Network* (visited July 11, 2000) http://www.dishnetwork.com/customer_service/third_level_content/installation/self_install/index.asp (EchoStar's installation kit supplies one 85-foot length of RG-6 coaxial cable and a second 2- to 15-foot length of RG-6 coaxial cable).

[99] Network Affiliates Joint Reply at 16-17 & n.61, citing Winegard Amp & Accessories Catalog, *Cable* (visited June 26, 2000) http://www.winegard.com/cable.html.

[100] Network Affiliates Joint Reply at 17 & n.62, citing *Longley-Rice Methodology for Evaluating TV Coverage and Interference,* OET Bulletin No. 69 (July 2, 1997), at 4 (Table 3). Network Affiliates state that the line loss (continued….)

transmission line loss planning factor and recommend that no changes be made to this factor.[101]

29. *(ii) Splitter Loss.* In its comments, SBCA urges than an additional factor for splitter loss be included in a revised distant network signal eligibility standard.[102] SBCA states that when the existing planning factors were developed the average household typically had only one television set, but now on average there are two television sets per household. SBCA then reasons that the average household would need to employ a "splitter" device that enables two TV sets to share a common antenna. It computes the loss in signal strength resulting from use of a splitter at 3 dB. Therefore, it recommends that a splitter loss factor of 3 dB be included in the revised eligibility standard.[103] EchoStar supports this recommendation.[104] NAB, however, insists that incorporation of splitter losses in planning factors is inappropriate.[105] It explains that the question of whether households receive a Grade B field intensity in the air above their rooftop is not predicated on their choice to split, or not to split, the signal once it comes into the house.[106] It explains that signal amplifiers that overcome the effect of splitter loss are readily and inexpensively available to consumers.[107] Network Affiliates agree with NAB's analysis.[108] MSTV points out that in our recent *SHVA Report and Order*, we rejected the argument that the Grade B standard should be modified to account for splitter loss.[109]

30. We find it inappropriate to account for splitter loss in the eligibility standard planning factors. As the broadcast commenters correctly point out, the issue of whether a sufficient signal strength is present for over-the-air, rooftop reception is independent of a household's choice to use splitters to distribute the signal to multiple TV sets in the home. In any event, "no loss splitters" (*i.e.*, distribution splitters), whose use does not result in any splitter loss, are readily and inexpensively available to the consumer market. Therefore, we do not recommend any change to the transmission line loss factor based on "splitter loss."

31. *(b) Receiving Antenna Gain.* The existing values for the Grade B planning factor for TV

(Continued from previous page)
in the planning factors for DTV reception is assumed to be 1 dB for low VHF, 2 dB for high VHF, and 4 dB for UHF. They observe that the values for VHF are the same as for the existing Grade B transmission line loss planning factor, but for UHF the 4 dB value is 1 dB less (*i.e.,* better) than the 5 dB value used in the Grade B planning factor.

101 We note that though the satellite industry comments posit the use of RG-59 cable, they have not explained why they chose to rely on that type of cable as opposed to the more appropriate choice of RG-6 cable.

102 SBCA Comments at 5, Attached Engineering Statement at 3 & Appendix 2 (table).

103 *Id.* (SBCA includes splitter loss in its proposed revision to the transmission line loss planning factor).

104 EchoStar Reply at 4.

105 NAB Comments, Attached Engineering Statement at ¶ 7.

106 NAB Comments at 51.

107 NAB Comments at 51, Attached Engineering Statement at ¶ 7; NAB Reply at 8, Attached Engineering Statement at ¶ 7.

108 Network Affiliates Joint Reply at 17-18 ("Section 119 compulsory copyright license has absolutely nothing to do with the number of television sets a household owns and operates"; cites examples of specific amplifiers available to consumers), Exh. 1 (Further Engineering Statement) at 6.

109 MSTV Reply at 5 & n.22, citing *SHVA Report and Order*, 14 FCC Rcd at 2673-74.

receiving antenna gain are 6 dB for the low- and high-VHF bands and 13 dB for the UHF band. Satellite interests urge that these values should be decreased. They stress that the existing values for this planning factor were based on the assumption that viewers would install separate VHF-only and UHF-only antennas but, today, most consumers who install rooftop antennas choose an all-band (*i.e.*, combined VHF-UHF) antenna, which reduces the available gain.[110] On the other hand, broadcast industry commenters state that the existing values are still appropriate. They state that standard practice is to use separate VHF and UHF antennas or better quality antennas for reception in outlying or fringe areas near the Grade B contour, and that antennas with gain meeting or exceeding the planning factor values are readily available to consumers.[111]

32. We find that the record does not support modification of the receiving antenna gain planning factor for Grade B. As we pointed out in the *NOI*, unlike the Grade A service areas that typically are comprised of urban or suburban environments located more closely to TV station transmitters, Grade B service areas include rural areas and presuppose the use of larger, directional receiving antennas.[112] The satellite industry comments and reply comments do not address this distinction, but without explanation appear to assume the use of antennas typically employed within the Grade A service areas.[113] As Network Affiliates point out, we have long recommended that consumers in outlying or difficult reception areas use separate UHF and VHF outdoor antennas, which provide better performance on UHF than a combination UHF/VHF antenna, at little or no additional cost.[114] In addition, 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.[115]

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[110] EchoStar Comments at 11-13; and SBCA Comments at 4.

[111] Network Affiliates Comments at 20 & Appended Engineering Comments at 5-6; NAB Comments at 45-50 & Attached Engineering Statement at 4; and MSTV Comments at 16-18.

[112] *NOI* at ¶ 10.

[113] See NAB Reply Comments at 8 (the lower average gain figures cited by EchoStar are based on mixing antennas appropriate for city-grade and Grade A areas with those for areas of weaker signal strength).

[114] Network Affiliates Joint Reply at 19 & n.69, citing *Improvements to UHF Television Reception*, GEN Docket No. 78-391, *Report and Order*, FCC 82-333, 90 FCC 2d 1121 (1982), at ¶ 50. Network Affiliates also point to comments submitted by the Electronics Technicians Association (whose members install antennas) in the recently completed *SHVA Proceeding*, CS Docket No. 98-201, that eight-bay and four-bay bowtie-with-screen antennas are the conventional UHF antennas for fringe rural areas. Network Affiliates Joint Reply at 19-20 & n.73, citing ETA Comments, CS Docket No. 98-201 (filed December 11, 1998), at 23. The average gain for such an eight-bay antenna was found to be 13.4 dB. Network Affiliates Joint Reply at 19 & n.72, citing *Improvements to UHF Television Reception*, 90 FCC 2d 1121 at Appendix B. Finally, we note that Network Affiliates (Joint Reply at 20-23 & Exh. 2) identify various outdoor receiving antennas, made for the consumer market by Channel Master and Winegard, whose gains exceed the existing planning factor values for Grade B.

[115] An example of this application is the addition of a 10-dB gain preamplifier at the antenna terminals of a 3-dB gain antenna to produce an effective gain of 13 dB. Using the UHF Grade B receiver noise figure planning factor of 15 dB and 5 dB line loss the expression (1) below yields a system noise figure which is 2.1 dB less than the planning factor value for the receiver noise figure. That is, $NF = 10 \log_{10} [10 + (100-1)]/10 = 12.9$ dB.

Noise figures of various parts of a receiving system all contribute to the overall system noise figure. The amount they contribute depends largely on the gain of the preceding stages in the system. The mathematical expression from which the noise figure of a system is calculated is as follows:

(continued….)

33. *(c) Use of Stationary Antenna.* As discussed above, we sought comment on the significance of Section 1005(a) of *SHVIA*, which amends the definition of an "unserved" household with respect to a particular TV network to mean that the household, *inter alia*, "cannot receive, through the use of a conventional**,** *stationary***,** outdoor rooftop receiving antenna, an over-the-air signal of a primary network station affiliated with that network of Grade B intensity." In many situations, where the network TV stations the consumer wishes to receive are all transmitting from a common direction, a stationary antenna properly oriented toward that common direction would provide the consumer with the best opportunity to receive each of those stations off-the-air. In other cases, where the stations are transmitting from different directions with respect to the consumer, a rotary antenna appears necessary for the consumer to receive each station's signal with maximum strength. In this context, we are concerned with the proper interpretation of the statute's reference to a "stationary" antenna.

34. In its comments, EchoStar points out that, in the *SHVA Report and Order*, the Commission determined that the measurement of the strength of each network signal required orienting the measurement antenna to the particular transmitter in question.[116] EchoStar urges the Commission to "clarify" the measurement methodology so that the "[signal] intensity for all local stations would be measured with the consumer's antenna oriented towards the network station most frequently watched by that consumer. Only in this way could the signal intensity actually received by the consumer be reflected in the measurements as opposed to the theoretical case of a consumer using an expensive rotary antenna to constantly adjust his or her picture. Such a change would also be consistent with the SHVIA, which has added the specification of a 'stationary' antenna."[117]

35. Network Affiliates, in their comments, assert that, by inserting the word "stationary," Congress intended only to specify that signal strength measurements should not be taken using the mobile run methodology.[118] Mobile field strength runs are performed to gain information regarding the variability of signal strength in the vicinity of a particular measurement location. This variability of signal strength is caused by multipath reflections or shadowing/absorption due to terrain, vegetation, buildings or other man-made obstacles. Generally, mobile run measurements are made continuously over 100 linear feet in distance, are centered on the specific measurement location point, and provide information regarding maximum, average, median and standard deviation values of signal strength in the area. Thus, the measuring antenna is mobile, and not stationary, when mobile run methodology is used. Network Affiliates further state that Congress did not intend to alter the long-standing basis of signal strength measurement that the receiving antenna is properly oriented toward the desired station, so that the antenna is most likely able to measure the signal at its best available strength.[119]

36. In our view, the statutory use of the term "stationary" has some ambiguity in the present context. It could be interpreted, consistent with existing practice, to mean that signal strength

(Continued from previous page)

$$(1) \quad NF_{system} = 10 \ \log_{10} f_1 + (f_2 - 1)/g_1 + (f_3 - 1)/g_1 g_2$$

Where f_1, f_2 refers to the noise factor for of each stage and g_1, g_2 refers to the gain of the stage.

[116] EchoStar Comments at 17-18 & n.37, citing *SHVA Report and Order*, 14 FCC Rcd at 2654 ¶ 59.

[117] EchoStar Comments at 18.

[118] Network Affiliates Joint Comments at 18.

[119] *Id.*, citing *Jay Lubliner and Deborah Galvin, Potomac, Maryland, Memorandum Opinion and Order,* FCC 98-201, released August 21, 1998, at ¶ 16.

measurements are to be taken with the receiving antenna properly oriented to receive the best available signal from the desired station. In many cases, all the desired stations would be transmitting from a common direction in relation to the viewer. In these cases, a conventional, stationary, outdoor rooftop receiving antenna would be sufficient; no rotor would be necessary. Thus, the statutory amendment could simply be aimed at clarifying that consumers would not be expected to buy a rotary antenna if they indeed had no need of one. Another possible meaning of the amendment, as suggested by EchoStar, is that consumers should only be required for *SHVIA* purposes to employ a non-rotary antenna aimed at their favorite network station, even in cases where other network stations lie in different directions. A third possible meaning, as Network Affiliates suggest, is to specify that signal strength measurements for *SHVIA* purposes should not be taken using the mobile run methodology.[120] Support for this interpretation is provided in the legislative history by the statement of Senator Leahy that the "new language says only that the antenna is to be 'stationary'; it does not say that the antenna is to be improperly oriented, that is pointed in way that does not obtain the strongest signal. The word 'stationary' means, for example, that testing should be done using a stationary antenna, as the FCC has directed."[121] We do not believe that the statutory amendment requires us to adopt EchoStar's interpretation, nor do we believe that Congress intended such a result. We agree with Network Affiliates, on the other hand, that *SHVIA's* legislative history indicates strong Congressional support, including the above comment of Senator Leahy, for maintaining the current requirement that signal strength measurements for *SHVIA* purposes be made with the receiving antenna properly directed to each of the desired local network stations' transmitters. Thus, on passing *SHVIA*, Senator Hatch, Chairman of the Conference Committee and the Senate Judiciary Committee, specifically stated:

> I would clarify one other point relating to a minor modification we made to the definition of "unserved household" in the distant signal satellite statutory license found in section 119 of Title 17 of the United States Code. The conferees decided to add the word "stationary" to the phrase "conventional outdoor rooftop receiving antenna" in Section 119(d)(10) of the Copyright Act. As the Chairman of the Conference Committee and of the Senate Judiciary Committee, which has jurisdiction over copyright matters, I should make clear that this change should not require any alteration in the methods used by the courts to enforce the "unserved household" limitation of Section 119. *The new language states only that the antenna is to be "stationary"; it does not state that the antenna is to be misoriented (i.e., pointed away from the station in question).* Any interpretation that assumed misorientation would be inconsistent with the basic premise of the definition of "unserved household," which defines that term in relation to an individual TV station rather than to all network affiliates in a market—and speaks to whether a household "cannot" receive a Grade B intensity signal from a particular station. If a household can receive a signal of Grade B intensity with a properly oriented stationary conventional antenna, it is not "unserved" within the meaning of Section 119. In addition, if station towers are located in different directions, conventional over-the-air antennas can be designed so as to point towards the different towers without requiring the antenna to be moved. And reading the definition of "unserved household" to assume misoriented antennas would mean that the "unserved household" limitation had no fixed meaning, since there are countless different ways in which an antenna can be misoriented, but only one

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[120] We have previously stated that use of the mobile run method is inadequate for the purposes of *SHVA. SHVA Report and Order,* 14 FCC Rcd 2654 at ¶ 48.

[121] 145 Cong. Rec. S15020 (daily ed. Nov. 19, 1999) (statement of Sen. Leahy).

> way to be correctly oriented, as the Commission's rules make clear.[122]

Similarly, Congressman Coble further clarified:

> I want to stress that this one-word change to the Copyright Act does not require (or even permit) any change in the methods used by the courts to enforce the "unserved household" limitation of Section 119. The new language says only that the test is whether a "stationary" antenna can pick up a Grade B intensity signal; although some may have wished otherwise, *it does not say that the antenna is to be improperly oriented (i.e., pointed away from the TV transmitter in question). To read the Act in that way would be extraordinarily hypocritical*, since "stationary" satellite antennas themselves must be perfectly oriented to get any reception at all."[123]

There is no contrary legislative history indicating that *SHVIA* requires anything less than use of an antenna properly oriented toward the local network station(s) at issue. We therefore conclude that the statutory use of the term "stationary" has no affect on the Grade B planning factors used to determine distant network signal eligibility.

37. *Dipole Factor.* Another Grade B planning factor is the mathematical relationship between the signal strength output of the receiving antenna and the strength of the electromagnetic field in which the antenna is located. This relationship is known as the dipole factor. The existing values for the Grade B dipole planning factor are –3 dB, 6 dB, and 16 dB for the low VHF, high VHF, and UHF television band, respectively. In the *NOI,* we explained that the current Grade B planning factors are based on dipole factors determined at the geometric mean frequency of each of the three television bands.[124] That is, for the entire Low VHF band, a single dipole factor was computed based solely on the mid band frequency of 69 MHz. Similarly, the High VHF band dipole factor was based on the frequency of 194 MHz; and the UHF band dipole factor was based on the frequency of 645 MHz. In MM Docket No. 87-268, which dealt with planning factors for DTV, however, the Commission used the *precise value* of the dipole factor for each UHF DTV channel. Had the previous methodology been used for DTV, a single dipole factor would have been computed based solely on the allotment for the DTV mid-band channel 38 frequency of 617 MHz for all UHF DTV channels. The computation of distinct DTV dipole factors, however, reveals that reception on DTV channel 14 needs 2.3 dB less field strength, and DTV channel 69 needs 2.3 dB more, than the field strength value for the DTV mid-band channel.[125] For the purpose of achieving consistent service replication data for DTV, this same methodology was used to modify the Grade B field strength values (set forth in 47 CFR § 73.683) applicable to existing analog UHF stations.[126] Because the VHF television band covers a much smaller range of frequencies, this methodology does not produce significant differences in the dipole factor for VHF television reception. In light of this information, we sought comment on whether the modifications to the dipole factor applied to the DTV planning factors should be extended to also apply

[122] 145 Cong. Rec. S14991 (daily ed. Nov. 19, 1999) (statement of Sen. Hatch) (emphasis added).

[123] 145 Cong. Rec. H12814 (daily ed. Nov. 18, 1999) (statement of Rep. Coble).

[124] *NOI* at ¶ 19.

[125] In particular, the dipole factor modification used for the DTV Table of Allotments equaled 20 times $\log_{10}$ of the ratio of the center frequency of the UHF channel of interest to the center frequency of channel 38.

[126] Since this modification to the planning factors does not produce significant differences in the VHF television bands, DTV allotment planning used this modification only for the UHF band.

to modification of the analog television Grade B standard for the purposes of *SHVIA*.[127] We also asked whether these theoretical calculations of the dipole factor and the resulting system gains used in the Grade B planning factor are reflective of the actual energy transference of today's home receiving antennas.

38. EchoStar comments that, in order to account for the change in system impedance from 300 ohms to 75 ohms, and to reflect the removal of channels 70-83 from the television UHF band, the dipole factors must be adjusted upward.[128] EchoStar further asserts that the Grade B planning factors include an impedance transformation term that should be removed inasmuch as the intrinsic impedance of a dipole is approximately the 75-ohm impedance of the modern receiving system.[129] Removal of channels 70-83 from the television UHF band, EchoStar states, changes the geometric mean frequency for all remaining UHF channels to 615 MHz. EchoStar concludes that the dipole factors should be changed to 3, 12, and 22 dB, respectively, for the low VHF, high VHF, and UHF television bands. Network Affiliates and NAB state the existing values for the dipole factor are accurate but, because they are based on the geometric mean frequency of each of three bands, they do allow for a range of variability of approximately +/- 2.3 dB from the top to the bottom of the UHF band.[130] They add that if the Commission wished to define the dipole factor more accurately to account for this variability, it could slightly modify the UHF value by creating five sub-bands and making the following adjustments to the existing value of 16 dB: Channels 14-23 (-2 dB adjustment); Channels 24-33 (-1 adj.); Channels 34-46 (no change); Channels 47-59 (+1 dB adj.); and Channels 60-69 (+2 adj.). No change is needed for the VHF bands, they state, because there is little variability in those bands.

39. We see no reason to recommend changing either the dipole factor or the thermal noise factor based on the system impedance. As Network Affiliates accurately elaborate in their reply comments, a change from 300-ohm to 75-ohm impedance systems has equal but inverse effects upon the dipole and thermal noise factors.[131] Specifically, because 75-ohm systems would have 6 dB less thermal noise than 300-ohm systems but would have a 6 dB greater dipole factor, these changes would have no net effect on the resultant required median field.[132] Also, we do not recommend the suggestion of Network Affiliates and NAB to reduce UHF dipole value variability by adjusting that value slightly, from a range of –2 to +2 dB over five sub-bands, because the proposed adjustments would be minor in effect, would add complexity to the planning factors, and would only be transitional and short-lived. The range of variability for the UHF band will decrease as the upper portion of that band is reallocated for other services.[133]

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[127] *NOI* at ¶ 20.

[128] EchoStar Comments at 13-14.

[129] *Id.* at 13 n.31. Likewise concerning the effect of the change from 300-ohm to 75-ohm impedance receiver systems, EchoStar states that the planning factor for thermal noise should be "reduced somewhat." *Id.* at 6-7.

[130] Network Affiliates Joint Comments, Appended Engineering Comments at 5; NAB Comments at 51-52.

[131] Network Affiliates Joint Reply at 3-5 & Attached Further Engineering Statement at 6-9. *See* NAB Reply at 10.

[132] *See* ¶ 10 (Grade B Planning Factors Table), *supra.*

[133] Channels 60-69 have already been reallocated for wireless communications services. *Reallocation of Television Channels 60-69, the 746-806 MHz Band*, ET Docket No. 97-157, *Report and Order*, 12 FCC Rcd 22953 (1998). The 24 megahertz of spectrum at 764-776 MHz and 794-806 MHz were allocated to the fixed and mobile services, and designated for public safety use. The remaining 36 megahertz of spectrum were allocated to the fixed, mobile, and new broadcasting services. The guard bands (746-747, 762-764, 776-777, and 792-794 (continued….)

40. *Field Strength Variability.* As we explained in the *NOI*, VHF and UHF field intensities vary not only with time, but also with location.[134] By virtue of the relatively short wavelengths involved, it is common for field strength levels to vary several dB over relatively short distances of a few yards for VHF frequencies and a few feet for UHF frequencies. Variations of this kind are a function of frequency and terrain. The location variability factor is expressed in dB and represents the difference between the median field that is exceeded at 50 percent of the locations and the field exceeded for some other percent of the locations. One way to account for these variability factors is to build them directly into signal strength values. The Grade B intensity levels are actually median signal strengths -- *i.e.*, 50% of locations in a particular area should receive a Grade B signal or higher at least 50% of the time. However, this does not mean that 50% of the locations will receive an *acceptable picture* only 50% of the time. As discussed above the Grade B values have a built-in time factor so that an acceptable picture is predicted at least 90% of the time. For example, a signal strength of 41 dB/μv/m provides an acceptable picture for channels 2-6. To ensure that a location receives such a signal 90% of the time, the Grade B value for those channels, 47dB/μv/m, includes an added time factor of 6 dB.[135] Thus, although a location receiving a Grade B signal of 47 dB/μv/m will only get that signal 50% of the time, that same location will receive a 41 dB/μv/m signal 90% of the time. Two of the existing Grade B planning factors take into account field strength variability: the time fading factor and the terrain factor. The time fading factor, as indicated above, was chosen to assure that a viewer who receives a signal of at least Grade B signal strength will receive an acceptable picture at least *90%* of the time. The existing time fading factor values are 6 dB for low VHF, 5 dB for high VHF, and 4 dB for UHF channels. The terrain location factor was chosen to assure that, along the Grade B signal strength contour, at least *50%* of all locations along the contour will receive a signal of at least Grade B strength. The existing terrain factor values are 0 dB for each of the three TV frequency bands. In light of these facts, we asked for comment on the appropriateness of the field strength variability factors used in the Grade B field intensity standard when determining distant network signal eligibility. We sought comment on the appropriateness of the field strength time variability factor used in the Grade B standard when determining distant network signal eligibility. In other words, we asked whether the prediction of an acceptable picture at least 90% of the time is an inadequate standard for the average television viewer. Further, we asked for information regarding the results of any technical studies and analysis of those studies that would clearly support a different value for the time variability factor for the purposes of determining distant network signal eligibility. Finally, in those cases where comments

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MHz) have recently been auctioned to band managers, whose business is to subdivide and lease their spectrum to third parties for both commercial and private wireless services. This auction closed on September 21, 2000. *See* http://www.fcc.gov/Bureaus/Wireless/News_Releases/2000/nrwl0035.html. The remaining spectrum at 747-762 and 777-792 MHz is scheduled to be auctioned beginning March 6, 2001. *See Public Notice*, WT Docket No. 99-168, FCC 00-282, released July 31, 2000. *See generally Rules for the 746-764 MHz and 776-794 MHz Bands*, WT Docket No. 99-168, *First Report and Order*, FCC 00-5, released January 7, 2000. Channels 52-59 are to be reallocated at a later time. *See Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service*, MM Docket No. 87-268, *Sixth Report and Order*, FCC 97-115, released April 21, 1997, at ¶¶ 76-84.

We also believe that technological developments over the decades have created a safety margin providing consumers greater assurance of adequate reception than the Grade B planning factors predict, including the upper UHF channels. Finally, we note that Fox has warned that the creation of inconsistent measures of adequate signal intensity for determining TV station service areas could lead to undesirable "collateral consequences." Fox Comments at 7-8.

[134] *NOI* at ¶¶ 21-22.

[135] See discussion at ¶ 6 n.20, *supra.*

support a time variability factor for signal levels greater than the 90^{th} percentile, we sought information regarding the availability of propagation data that clearly supports the proposed value of time variability.

41. In its comments, SBCA urges that the time fading factor values should be increased to 9 dB for each of the three TV bands. SBCA reasons that the planning factors were never adjusted to conform to new propagation curves that the Commission adopted in the 1970s, and that application of the original calculation method to the newer propagation curves results in the 9 dB value.[136] Broadcast industry commenters, on the other hand, support the existing time fading factor values.[137] NAB adds that "the time fading factor is a function of distance, so when field strength is being predicted at something less than the extreme distance, appropriate factors would be less than those in the table. Leaving the time fading factors as at present introduces an element of conservatism in predicting field strength at the lesser distances."[138] As to location variability (*i.e.*, the terrain factor, which, for Grade B, currently has a 0 dB value), MSTV comments that this planning factor should remain unchanged because the ILLR measurement methodology appropriately accounts for location.[139] NAB agrees.[140] EchoStar also proposes no change to this factor.[141]

42. In reply comments, NAB and Network Affiliates state the change to the time fading factor proposed by SBCA is not necessary, because it is premised on reception distances (approximately 60 miles or more from the transmitter) that are well beyond those at which the bulk of households that might seek to view distant signals are located (50 miles or less).[142] At these closer distances which are more likely to be

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[136] SBCA Comments at 2, 5-6 & Attached Engineering Statement at 3-4 & Appendix 2, citing G.S. Kalagian, *A Review of the Technical Planning Factors for VHF Television Service*, Research and Standards Division, Office of Chief Engineer, FCC/OCE RS 77-01, March 1, 1977, and *UHF Comparability Report* at Table B-2.

[137] MSTV Comments at 18-21; NAB Comments at 52 & Attached Engineering Statement at 7-8; Network Affiliates Joint Comments at 20 & Appended Engineering Comments at 4. We also note that EchoStar appears to support retention of the existing time fading factor values. *See* EchoStar Comments at 17 (table). Additionally, in response to the *NOI* question concerning time variability factors exceeding 90%, Network Affiliates and NAB point out that time fading follows a log-normal statistical distribution with a symmetrical variation about the median. They indicate that if the time fading factor were increased beyond the "90% of the time" confidence level, the result would be modified Grade B intensity values that are not log normal and time fading factor values that are unreliable. Network Affiliates Joint Comments, Appended Engineering Comments at 4; NAB Comments, Attached Engineering Statement at 7 ("extending the log normal assumption of variability beyond the ninety percent level is not appropriate because measurement data do not support the log normal distribution much beyond the range of ten to ninety percent"). No comments propose a time variability factor beyond 90%, and we are not recommending any change in the use of the 90^{th} percentile in determining the values for this factor.

[138] NAB Comments, Attached Engineering Statement at 8.

[139] MSTV Comments at 20-21, citing *SHVA Report and Order*, 14 FCC Rcd at 2691.

[140] NAB Comments, Attached Engineering Statement at 7 ¶ 9 (use of ILLR "removes any need to consider location variability. Making that statement does not mean that field strength cannot vary within a few meters or tens of centimeters, depending on the wavelength. Of course it can, but ILLR at least provides for a much narrower range of probable signal variability than, for instance, might be predicted by application of the FCC prediction method. Furthermore, since the change can be either to increase or decrease the signal, use of the present 0 dB location variability planning factor is appropriate.")

[141] EchoStar Comments at 17 (table).

[142] NAB Reply at 8-9 & Attached Engineering Statement at ¶¶ 2-3; Network Affiliates Joint Reply at 24-25.

in issue for purposes of determining distant network signal eligibility, Network Affiliates adds, the new propagation curves support corrected time fading factors of 5 dB or less in the VHF band.[143] NAB adds that "even if the time fading factor were revised upwards by a few dB, that change would be much more than offset by improvements in receiver noise and other factors."[144]

43. *(a) Time Fading.* As noted by SBCA, the time fading planning factor was never adjusted to conform to the new propagation curves that the Commission adopted in the 1970s. Conformance with the newer propagation curves would result in time fading values different from those currently applied as a Grade B planning factor. We also observe, however, that the original calculation of the Grade B signal intensity considered values of time fading at the most distant household reachable by TV stations operating at maximum power and antenna height licensable under FCC rules. Time fading generally increases with distance from the transmitter. We therefore find that it is appropriate to consider the effects of modifying the method for determining distant network signal eligibility to account for the newer propagation curves and the distance-sensitive nature of time fading.[145] In lieu of the existing fixed values of the time fading factor, we believe an appropriate modification would be to substitute time fading values determined for the actual receiving location by the Individual Location Longley-Rice prediction model.[146] The use the Individual Location Longley-Rice prediction model would provide a simple, cost-effective method to adjust the time fading planning factors to conform to the new propagation curves. The value of the Grade B signal intensity would then depend on the actual location of the household of interest and as such would more accurately describe a minimum signal level that is necessary to provide an acceptable picture quality. This modification of the method for determining the Grade B intensity would tend to increase the number of unserved households in the outer 2 to 3 miles of the traditional Grade B coverage area of VHF stations with maximum facilities. Up to about 7 miles of traditional coverage might be affected in the case of maximum facility UHF stations. This is the result expected by SBCA in urging readjustment of the time fading factors. The tendency would be opposite for these same stations at some receiving locations within the first 40 miles of the transmitting antenna of UHF stations and the first 50 miles of the transmitting antenna of VHF stations. These would be close-in, difficult receiving locations where under the current rules the predictive signal intensity is determined to be less than 4 to 6 dB above the minimum values of the

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[143] Network Affiliates Joint Reply at 25. Also, Network Affiliates states the 9 dB value proposed by SBCA is very conservative, because it ignores the fact in Zone I time fading is slightly less severe than in Zones II and III. It cites a 1977 report from the Office of Chief Engineer indicating that: in Zone I, the values should be 8 and 7 dB for low- and high-VHF band, respectively; and, in Zone II, 9 dB in both VHF bands. Also, it indicates that the source of the 9 dB value for the UHF band was an unpublished draft by Commission staff that did not differentiate among the Zones. *Id.* at 24-25, citing G.S. Kalagian, *A Review of the Technical Planning Factors for VHF Television Service,* Research and Standards Division, Office of Chief Engineer, FCC/OCE RS 77-01, March 1, 1977, at 9 (Table 4B, line 16); *UHF Comparability Final Report* at 252 (Table B-2); and *UHF Comparability Preliminary Analysis* at 183 n.4 (citing G.S. Kalagian, *UHF Television Planning Factors*, unpublished draft (1979)).

[144] NAB Reply Comments at 9.

[145] The modification we consider would also assure consistency with the television coverage calculations that have been used for several years since the establishment of the digital television service. *See* "Longley-Rice Methodology for Evaluating TV Coverage and Interference," OET Bulletin 69, Federal Communications Commission (July 2, 1997) <http://www.fcc.gov/oet/info/documents/bulletins/#69>. *See also* 47 CFR §73.622(e).

[146] *See Establishment of an Improved Model for Predicting the Broadcast Television Field Strength at Individual Locations,* ET Docket No. 00-11, *First Report and Order*, FCC 00-185, released May 26, 2000.

Grade B standard due to terrain shielding or other difficult propagation conditions. At these locations the predicted number of unserved households could decrease under this modification.

44. Under the *SHVIA*, individual testing is provided as a key safety net mechanism for proving that a specific household is unserved and thus eligible under the law to receive satellite delivery of distant network signals. This testing is based on the premise that it is to be a relatively low cost, accurate, and reproducible methodology for measuring the presence of the signal intensity at an individual location. Section 73.686(d) of our rules sets forth this testing methodology that provides for a limited number of measurements made in a one-time measurement program. Because of the limitations on the length of testing and the number of measurements made, only median values of signal intensity can be accurately determined. Therefore, when determining the value of signal intensity to be measured at a household, the time fading factor determined for the individual location by the ILLR model would have to be added to the median value of signal intensity as determined by the planning factors. This would effectively yield the value of the signal intensity necessary to provide an acceptable picture 90 percent of the time.

45. In sum, the modification of the Grade B signal intensity time fading planning factor as described above and the resultant changes in the minimum signal intensity values could have two opposing effects on the total number of households deemed unserved. On the one hand, it might increase the number of households located within the outer portions of coverage areas of maximum facility stations which are deemed unserved. On the other hand, it might decrease the number of households located within close-in, difficult reception areas which are deemed unserved. However, we believe that the number of newly predicted served locations in close-in, difficult reception areas will be very small compared to the number of newly predicted unserved locations in the outer edges of station coverage. In addition, the use of actual, location-dependent, time fading values, as determined for each receiving location examined, would improve the Grade B signal intensity standard to more accurately describe a minimum signal level that would be necessary to provide an acceptable picture quality 90 percent of the time. Therefore for the purpose of determining distant network signal eligibility, we are recommending that the Grade B signal intensity standard be modified to incorporate this new time fading factor which uses the actual, location-dependent, time fading values at individual households as determined by the use of the ILLR.

46. *(b) Terrain Variability.* We do not recommend any change to the terrain planning factor, and no commenter has proposed any change to it. As we previously explained in the *SHVA Report and Order*:[147]

> In the ILLR, location variability becomes effectively irrelevant because only one location (*e.g.*, a single household) is considered. The individual mode merges location variability (the measurable observable differences between dissimilar locations) and so-called situational variability (the small, often hidden, differences between similar or identical locations) into the statistical confidence factor.

Therefore, there is no justification for changing the Grade B location variability planning factor.

47. *Environmental Noise.* Environmental noise is generated by noise sources that are external to the receiver and that are generally located in the area around the receiver location. Unlike internal noise discussed above, in relation to the receiver noise factor, external noise is generally highly non-Gaussian and tends to be impulsive in nature. As we explained in the *NOI,* external noise can be divided into several categories.[148] Usually, external noise is categorized according to whether it is of atmospheric, galactic, or

[147] 14 FCC Rcd at 2691.

[148] *NOI* at ¶ 23.

man-made origin. Since atmospheric noise usually predominates at frequencies below 30 MHz, it generally disturbs only the reception of channels within the low VHF band, but even that disturbance is only sporadic in nature. The major source of atmospheric noise is lightning. For instance, low VHF band disturbances, particularly on channel 2, can be noted during strong local thunderstorms. Generally, galactic noise levels exceed atmospheric noise levels in the overall low VHF band. Nevertheless, with the rapid growth of man-made noise sources (*e.g.*, emissions from automobile ignitions, electric motors, electric power transmissions, fluorescent lights, computers and other electronic equipment), man-made noise levels generally exceed both atmospheric and galactic at all television frequencies. In light of the above facts, the *NOI* sought comment on whether the planning factor values currently used to account for environmental noise levels values (*i.e.*, planning factor 11 in the Grade B Planning Factors Table) are appropriate for a standard to determine distant network signal eligibility.[149] We asked, for example, whether environmental noise levels have increased (or decreased) and, if so, how should this affect any distant network signal eligibility standard. We also sought information regarding the results of any technical studies that might indicate that there is need for a Grade B environmental noise factor, *i.e.*, a counterpart to the urban noise factor value used in determining the Grade A field intensity levels, for the purposes of determining distant network signal eligibility.

48. In its comments, EchoStar states that "naturally-occurring noise, apart from lightning, which is usually sporadic, is not generally believed to be a significant factor in television broadcasting, but man-made noise often is a nearly continuous ambient factor that degrades the displayed picture."[150] EchoStar points out that demographic patterns have changed significantly over the decades, resulting in today's "urban sprawl" that surrounds many of the larger cities in the nation. Many of the areas near the outer edges of TV Grade B service areas, EchoStar indicates, were once rural areas but are now suburban. EchoStar claims that increased signal intensity is necessary in those areas to overcome the accumulation of effects of various man-made noise sources such as automobile ignition, discharge lighting, and electric hair dryers. These noise sources, EchoStar states, become increasingly important in direct proportion to population density. EchoStar urges that, while the planning factor "to overcome urban noise" was set at 0 dB in the 1950s, the long-term demographic trend toward "suburbanization" requires that a "man-made" noise factor now be included in the Grade B planning factors. EchoStar states the Commission has previously observed that "large population shifts from cities to suburban areas . . . cause the Grade B contours in these areas to no longer lie in 'rural' areas. The assumption of 0 dB to overcome rural noise in these 'rural areas' is probably no longer valid. . . ."[151] EchoStar posits that "to account for the effects of increased population density in areas that were rural 40 years ago, it is appropriate and necessary to apply [as a Grade B planning factor] the urban noise factors currently used for establishing the Grade A required field strengths. These values are 14, 7, and 0 dB, for the VHF-low, VHF-high, and UHF bands, respectively."[152] SBCA agrees that the existing 0 dB Grade B urban noise factor is insufficient, but does not propose any specific replacement values.[153]

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149 *NOI* at ¶ 24.

150 EchoStar Comments at 14.

151 EchoStar Comments at 15, citing G.S. Kalagian, *A Review of the Technical Planning Factors for VHF Television Service*, Research and Standards Division, Office of Chief Engineer, FCC/OCE RS 77-01, March 1, 1977, at 11.

152 EchoStar Comments at 16.

153 SBCA Comments at 2-3 (urging overall revised Grade B required median field values of 70.75 dB• for low-band VHF, 76.5 dB• for high-band VHF, and 92.75 dB• for UHF band, and claiming these values are (continued….)

49. In his comments, Biby opines that the "definitive source" on the subject of radio noise is a book by Edward N. Skomal.[154] According to Biby, "Skomal provides graphical representations of the measured noise across the radio frequency spectrum in business, residential and rural areas. (He defines residential areas as those locations of single- or multiple-family dwellings with densities of two families or more per acre, while rural areas are those having a dwelling density of one or fewer per 5 acres with an associated land use that is dominantly agricultural.) According to Skomal, typical median man-made noise levels are: [for Channel 2, 20 dB in rural areas, 25 dB in residential areas, and 30 dB in business areas; and for Channel 13, 3 dB (rural), 8 dB (residential), and 13 dB (business)]."[155] Biby concludes that man-made noise should be included in the Commission's predictive model and, until a sufficient body of observational data can be collected and built into the Commission's model, he suggests that Skomal's values be used.[156]

50. The other broadcast industry commenters, to the contrary, suggest that the Grade B planning factors do not need to be adjusted to account for environmental noise. NAB states that it is not aware of any reliable studies showing or quantifying an increased level of man-made noise in the Grade B area.[157] NAB adds that "as America has made the transition from a smokestack economy to a high-tech economy, many noise sources may actually have been reduced since the 1950s. In any event, only in the low-VHF band is environmental noise a consideration at all."[158] Network Affiliates agree, acknowledging that "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."[159] They also state that "the Commission has examined the issue of urban noise and determined that the effects are significant only for low VHF frequencies."[160] Additionally, Network Affiliates state that "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 shield noise generators."[161] Finally, Network Affiliates advise that the Commission's "Technical Advisory Committee is currently engaged in examining man-made noise and its potential impact on wireless devices. This effort

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conservative because they have not been adjusted to account for man-made noise, ghosting and continually increasing consumer expectations concerning acceptable picture quality).

[154] Biby Comments at 3, citing Edward N. Skomal, *Man-Made Radio Noise* (Van Nostrand Reinhold, New York).

[155] Biby Comments at 3.

[156] Biby Comments at 3 & Appendix A (computer program listing that, Biby asserts, calculates man-made noise based on Skomal's research).

[157] NAB Comments at 52 & Attached Engineering Statement at ¶ 11. *See also* Fox Comments at 5 (Fox unaware of any evidence that environmental noise has changed demonstrably).

[158] NAB Comments at 52-53 & Attached Engineering Statement at ¶ 11.

[159] Network Affiliates Joint Comments, Appended Engineering Comments at 3.

[160] *Id.* at 3-4, citing *Television and FM Field Strength Curves*, Docket Nos. 16004 and 18052, *Report and Order*, FCC 75-636, 34 RR 2d 361 (1975), at ¶ 46.

[161] *Id.* at 4.

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."[162] MSTV adds that the existing planning factor values represent the best figures currently available and should not be changed without a scientific study based on comprehensive measurements of environmental noise.[163]

51. In its reply, NAB states that there is no basis for adding an urban noise factor to the Grade B planning factors, because urban noise is only significant in the more industrialized portions of a city and has little effect in the outlying residential areas.[164] It reiterates that no comprehensive study of man-made noise exists, and there is substantial reason to expect industry efforts (such as those by automobile manufacturers) to succeed at controlling and reducing noise sources.[165] Network Affiliates agree.[166] They add that the Commission's *A Review of the Technical Planning Factors for VHF Television Service,* relied upon by EchoStar,[167] ultimately concluded that the rural noise factor should be 0 dB.[168] Network Affiliates additionally state that "the UHF Comparability Task Force, in 1980, which was also engaged in deriving modified Grade B values, also ultimately concluded that no account need be taken of rural noise for Grade B purposes."[169] In general agreement with NAB and Network Affiliates, MSTV adds that EchoStar's proposal is based on speculation and vague assertions about demographic changes, which the Commission recently rejected in the *SHVA Report and Order*.[170] In particular, MSTV states, the Commission concluded that no change to the urban noise factor was warranted, finding that "the technology of receivers and antennas has kept pace with changing consumer expectations and increased noise."[171]

52. We find that the record does not contain any current and substantial studies of man-made noise that could provide the basis for new values of environmental noise for television planning factors. There is

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[162] *Id.*

[163] MSTV Comments at 21.

[164] NAB Reply at 9-10, citing Neil M. Smith, *Relationship of Television Picture Quality to Field Intensity* (March 20, 1971) (attached to Comments of PrimeTime 24, CS Docket No. 98-201 (filed December 11, 1998)). NAB also points out that, consistent with its position that the 0 dB urban noise values should be maintained for Grade B, the Commission has more recently set the values for the DTV urban noise factor at 0 dB for each band.

[165] NAB Reply at 9-10 & Attached Engineering Statement at ¶ 4 ("Better suppression of ignition noise to avoid interference with the extensive use of electronic devices in modern cars, a decline in the prevalence of heavy industry, and the increasing use of buried power distribution systems would tend to reduce man-made noise in cities and their suburbs.").

[166] Network Affiliates Joint Reply at 25-28 & Exh. 1 (Further Engineering Statement) at 9-10.

[167] *See* note 151, *supra*.

[168] Network Affiliates Joint Reply at 27, citing G.S. Kalagian, *A Review of the Technical Planning Factors for VHF Television Service*, Research and Standards Division, Office of Chief Engineer, FCC/OCE RS 77-01, March 1, 1977, at 9 (Table 4B, line 19).

[169] Network Affiliates Joint Reply at 27-28, citing *UHF Comparability Final Report* at 252 (Table B-2).

[170] MSTV Reply at 6-7, citing *SHVA Report and Order*, 14 FCC Rcd at 2673-2674.

[171] MSTV Reply at 6, citing *SHVA Report and Order*, 14 FCC Rcd at 2674.

a general suggestion in the record that demographic changes would likely have increased the environmental noise in the vicinity of TV station Grade B signal strength contours. This is, in turn, countered by the suggestion that changes in the nature of industry and its awareness of environmental concerns has led to decreases in environmental noise. We observe that Skomal's study, upon which Biby relies, was conducted in the 1970s and is not current, especially in view of the improvements in automobile noise emissions that we believe have occurred since then. This potential improvement in the reduction of emissions from motor vehicles was first noted by the Commission in 1983 and was prompted by the phenomenal growth of on-board electronics in motor vehicles, both in operational and entertainment equipment.[172] The temporal variation of Skomal's data appears to indicate a significant automotive contribution. In addition, Skomal's findings were based on a limited study involving only 300 hours of recorded data accumulated from observations in five different cities. Therefore, we conclude that insufficient data has been submitted to support any recommendation for an addition or modification to the existing planning factors based on environmental noise at this time. We recommend that no revisions be made to the planning factors based on environmental noise.

53. *Multipath Interference.* The *NOI* observed that, although not considered in the original service planning factors, multipath distortion, or ghosting, has been a pernicious problem since the beginning of television broadcast service.[173] Ghosting is the reception of at least two recognizable images of the desired picture, with each succeeding image displaced horizontally by an amount corresponding to the echo delay. An echo is usually caused by the existence of another transmission path that parallels the main path. Ghosting can consist of multiple echoes, and individual echoes may be leading or lagging the main signal image received. The range of possible echoes is large, but when the delay is close to zero, the echo image cannot be resolved, and the effect is to impair the picture definition (*i.e.*, blurring). Echoes with delays up to tens of microseconds occur in television broadcasting, because of its vulnerability to reflections from buildings and other structures away from the direct path between the transmitter and receiver. Included in this problem are "moving ghosts" or "picture flutter," which is caused by reflections from passing airplanes. In recent years much concern has been raised regarding television signal intensity levels and their affect on receiver picture quality. This has been true even though multipath impairments are generally independent of field strength levels at the receiver. However, until recent works on ghost canceling technology, models for predicting over-the-air received television picture quality have generally ignored the impact of ghosting on television reception. While many improvements to the television broadcasting system have been implemented over the years, degraded images associated with multipath ghosting have not diminished, and ghosting continues to reign as the most annoying impairment of the over-the-air television service. The viewer, nonetheless, can take certain actions, such as turning or moving the antenna, to minimize ghosting.

54. It has been suggested that, in analog television, a desired-to-undesired signal ratio of at least 32 dB must be maintained between the direct and reflected television signal to reduce "ghost images" to less than a perceptible impairment. This value applies where the time separation is at least 2 μs, but may be less for smaller time separations.[174] Although ghosting is one of the most serious causes of poor picture quality or loss of service in television reception, no significant studies of television picture impairment by

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[172] *See Interference from Spark-type Ignition Systems in Motor Vehicles*, Docket 20654, *Memorandum Opinion and Order,* FCC 83-1, released January 4, 1983, at ¶ 6.

[173] *NOI* at ¶¶ 25-26.

[174] CCIR, 1990, Annex to Volume XI- Part 1, Report 478-2.

ghosting have been made, except in the case of relatively simple, single ghost images.[175] However, in most cases, ghost images are multiple and complex. Simply expressing the desired-to-undesired signal ratio, as is done in most interference analyses, is insufficient to quantify the impact of ghosting because the number of echoes, their phase relationships, and resultant delay are also important physical characteristics of ghosting. To completely analyze the impact of ghosting, these quantitative measures of multiple ghosts must be correlated with a subjective evaluation of the resultant impairment. To make things even more difficult, in order to use any quantitative value of ghosting for the purpose of developing a distant network signal eligibility standard, a method of predicting these values at a specific location must be available. However, we are not aware of any methodology for predicting the specifics of ghosting at a given location.

55. In light of the above considerations, the *NOI* sought comment on whether the eligibility standard should account for ghosting and, if so, what methods and values should be used.[176] We asked for comment on whether there are scientifically accepted models for predicting ghosting that should be used in determining an eligibility standard. We also sought comment on whether the effects of multipath interference should be included in the eligibility standard and, if so, how to account for them. In addition, we asked for comment on whether the eligibility standard should presume that the viewer will act to minimize ghosting and, if so, which viewer actions should be presumed, and how to account for those presumptions in the standards. We also sought information regarding the results of any technical studies of television picture impairment by ghosting. We indicated that such studies should include quantitative measures of multiple ghosts correlated with a subjective evaluation of the resultant impairment.

56. In its comments, EchoStar proposes a method of evaluating ghosting impairment and developing an "equivalence" rule to express ghosting-related impairment in terms of signal strength loss.[177] EchoStar's method relies on work published by several authors and an ITU recommendation expressing the relationship between picture quality and the objective value of specific distortions assuming only one of them is present at any one time. EchoStar's proposal for evaluating ghosting requires a technical measurement or calculation of the magnitude and delay of each ghost at each receiving location examined for distant network signal eligibility. SBCA endorses this approach.[178] On the other hand, Network Affiliates state that there is no need to modify the Grade B planning factors to account for ghosting.[179] In support, they explain that ghosting at a particular location is dependent on numerous variables including weather, time of year for areas with deciduous trees, wind, and moving vehicles and aircraft, so its presence

[175] See Recommendation 654, "Subjective Quality of Television Pictures in Relation to the Main Impairments of Analogue Composite Television Signal," ITU, CCIR XI-1, Broadcasting Service (Television), Dubrovnik, 1986; Report 478, "Ghost Images in Television," Questions 6/11 Study Programme 6A/11, ITU, CCIR XI-1, Broadcasting Service (Television), Dubrovnik, 1986.

[176] *NOI* at ¶¶ 26-27.

[177] EchoStar Comments at 18-26 & Attachments A-D (graphs).

[178] SBCA Comments at 7. *But see id.*, Attached Engineering Statement, Appendix 4 ("Substantial progress has been made in the characterization of multipath propagation especially at VHF frequencies, as a result of the implementation of digital PCS and cellular telephone systems. There have also been discussions of the use of "3D" propagation path modeling software for characterization of multipath effects on the digital television signal. Unfortunately, as outlined in TIA TSB-88A, there has not been adequate information to establish numerical methods for such computations, although such an effort should be made as a part of further studies to establish realistic modern NTSC (and digital television) planning factors.").

[179] Network Affiliates Joint Comments at 20.

cannot be predicted with accuracy at any particular location. In addition, they state, technical solutions already exist to eliminate the impact of ghosting.[180] NAB agrees and adds that the problem of ghosting is not subject to any scientific method of prediction.[181] It states that use of a properly oriented directional antenna will eliminate or reduce ghosting, and that consumers should be expected to make all reasonable efforts to receive strong off-the-air signals and minimize ghosting. NAB further states that ghosting can be almost completely eliminated through already-proven, off-the-shelf, ghost-cancellation technology. Finally, NAB states that to the extent that ghosting may be caused by tall buildings in "urban canyons" such as Manhattan, that problem has already been solved by the introduction of local-to-local satellite service in the major urban areas. This service, according to NAB, provides satellite subscribers with an effortless way to obtain ghost-free signals from their local network affiliates. In its comments, MSTV states that ghosting cannot be incorporated into the Grade B signal intensity standard and should not be considered in determining distant network signal eligibility because there is no scientifically accepted model for predicting ghosting.[182] MSTV points out that, in the *SHVA Report and Order,* the Commission explained that increasing signal strength also increases the severity of ghosting and noted that a consulting engineer for one of the satellite industry commenters had "acknowledge[d] that his proposed [increased Grade B] values d[id] not deal with the problem of 'multipathing' . . . and . . . that the stronger signal intensity he propose[d] 'may make the effect of multipathing more pronounced.'"[183]

57. In his comments, Biby states that ghosting is "possibly an even more prevalent cause of poor television reception than is man-made noise."[184] Biby proposes the following approach for predicting the potential for multipath reception at a given household:[185]

- Based on the terrain around the house and the characteristics of the local clutter, estimate the area within which ghost generation is likely to be a problem.
- Then examine that area for possible troublesome objects, using the available tower, terrain and land-use databases. For example, business/commercial land-use typically includes structures that are tall enough to cause ghosts at nearby households.

Biby appears to suggest a method of measuring ghosting by capturing digital picture frames using computer circuit boards that can function as TV receivers and then applying digital signal processing techniques to separate multipath signals from random noise.[186] As an alternative measurement

[180] *Id.* Network Affiliates opine that the fact that ghost-cancellation technology is not currently used in the industry may indicate that consumers do not view ghosting as a major problem.

[181] NAB Comments at 53-54 & Attached Engineering Statement at ¶¶ 12-14. NAB opines that the phenomenon of ghosting is extremely complex.

[182] MSTV Comments at 22. *See also* Fox Comments at 5 (no practical methodology exists to measure multiple ghosts, and no data has been gathered measuring the subjective effects of multiple ghosts).

[183] *Id.*, citing *SHVA Report and Order,* 14 FCC Rcd at 2671. MSTV also quotes the Commission as stating that "as the signal strength increases, the 'noise' in the picture is reduced. Unfortunately, noise . . . masks ghosting. Thus, as the noise is reduced, which is a benefit to picture quality in the absence of multipath problems, the ghosting disturbance becomes more noticeable." 14 FCC Rcd at 2671 n.101.

[184] Biby Comments at 3.

[185] Biby Comments at 4.

[186] Biby Comments at 4-5. Biby appears to include the effects of man-made noise, multipath reception, and co-channel interference from other television stations in his methodology. He states that, since interference has (continued….)

methodology, Biby appears to suggest the use of ghost-cancellation technology.[187]

58. In reply, NAB's consulting engineer states that EchoStar's proposal to account for "ghosting" is impractical, because it would require a visit to each receiving location by an expert in the measurement of multipath phenomena, and the use of expensive equipment, in order to evaluate the magnitude of, and delay caused by, ghosts.[188] He notes that only after obtaining this information about the multipath environment could EchoStar's proposal assign a metric for each echo that would then be correlated to the TASO or CCIR grading scale. He adds that ghosting can, in most cases, be controlled by using an antenna with suitable reception pattern and rotating it for optimum reception. In addition, he points out that sophisticated ghost-cancellation technology already exists, and that technology could readily be deployed if the problem of ghosting were considered significant. He therefore urges that the multipath phenomenon should not be considered within the context of the Grade B planning factors. Agreeing with NAB, Network Affiliates add that EchoStar's proposal is unworkable, because it requires objective knowledge at each location of the displacement, phase, and magnitude of each ghost.[189] Network Affiliates stress that the *SHVIA* does not contemplate that such measurements will be made by an expert capable of properly obtaining the requisite data at each and every household, but instead relies on an accurate predictive model for signal strength, the Individual Location Longley-Rice ("ILLR") model. They observe that in the *NOI* we stated that "in order to use any quantitative value of ghosting for the purpose of developing a signal standard for *SHVIA*, *a method of predicting these values at a specific location must be available*."[190] Further, Network Affiliates stress that "it is essentially impossible to model and predict all these ghosts in a *dynamic* environment of individual receivers," in which there are many variables that in turn may vary with small changes in time, location, or pointing angle.[191] Also, Network Affiliates observe that SBCA expressed concern that failure to reflect ghosting in the planning factors would "fail to do justice to the *millions of mainly urban consumers* counted as 'served' because they are predicted to receive a strong signal," but that the Section 119 license was enacted for the benefit of *rural* subscribers, not urban viewers.[192] Finally, Network Affiliates identify several readily available antennas for the consumer market that are designed to ameliorate multipath interference, and identify a manufacturer that offers ghost

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already been carefully considered in the Commission's TV channel allotment process, it is likely "to be the least pervasive of the three identified contributors to poor picture quality." *Id.* at 4.

[187] Biby Comments at 5-6. Biby also suggests that the Commission conduct a study to acquire data on which to base further improvements in its predictive model and "require signal strength and quality measurements be performed at some percentage of those households that claim inability to receive an acceptable network signal, regardless of the signal strength predicted by the Commission's 'new and improved' ILLR model." *Id.* at 6-7. This suggestion is not relevant to this proceeding, which is focused on developing a recommendation for a predictive, distant network signal eligibility standard. Instead, Biby's suggestion relates to the *SHVIA* measurement methodology, which is the subject of a different proceeding. *See Establishment of an Improved Model for Predicting the Broadcast Television Field Strength at Individual Locations*, ET Docket No. 00-11, *Notice of Proposed Rulemaking,* FCC 00-17, released January 20, 2000, *First Report and Order,* FCC 00-185, released May 26, 2000.

[188] NAB Reply, Attached Engineering Statement at ¶ 12.

[189] Network Affiliates Joint Reply at 41 & Exh. 1 (Further Engineering Statement) at 12-13.

[190] Network Affiliates Joint Reply at 41, citing *NOI* at ¶ 26 (emphasis added).

[191] Network Affiliates Joint Reply at 41 (emphasis added) & Exh. 1 (Further Engineering Statement) at 13.

[192] Network Affiliates Joint Reply at 39-40, citing SBCA Comments at 6 (emphasis added).

canceling integrated circuits specifically designed to reduce NTSC multipath signal echoes.[193] MSTV adds that EchoStar's proposal is illusory in that it does not provide any means for predicting the existence or severity of ghosting.[194] MSTV notes that EchoStar has admitted that "additional research is underway … to determine whether any generalizations can be made concerning the impairments caused by ghosting in specific classes of receiving situations (*e.g.*, LU/LC types)."[195] By contrast, EchoStar reasserts that its proposal is practical and feasible, and notes that Biby, a broadcast engineer, appears to agree with it that ghosting is a problem that should be addressed.[196]

59. We find that the record developed in this proceeding lacks any supportable methodology for including within the distant network signal eligibility standard a method for predicting or otherwise economically evaluating the impact of multipath interference on local television service. As we stated in the *NOI*, although ghosting is one of the most serious causes of poor picture quality or loss of service within television coverage areas, no significant studies of television picture impairment by ghosting have been made, except in the case of relatively simple, single ghost images. However, at most receiving locations that experience ghosting, the ghost images are multiple and complex. EchoStar's proposed method to account for ghosting would be cumbersome and costly to implement, in that it appears to involve case-by-case visits by experts to households, and it does not appear to include a method of predicting multipath interference at specific locations. Moreover, we observe that EchoStar appears to concede that its proposal is incomplete, admitting "additional research is underway … to determine whether any generalizations can be made concerning the impairments caused by ghosting in specific classes of receiving situations…. *Preliminary results* suggest that objectionable ghosting is very common…."[197] Biby's proposal also appears, at least in part, to involve visits to individual households by experts or technicians, and the use of technical equipment and analysis that does appear to fit the simple-test premise of the *SHVIA* measurement requirement. Thus, we continue to find that there still is no clear scientifically valid method of predicting ghosting at a given location. The existence of such a valid predictive method is paramount in revising our standard for determining distant network signal eligibility. In enacting *SHVIA*, Congress intended that any modifications we may recommend be consistent with the goal that the eligibility standard should remain a relatively inexpensive and simple test.[198] We conclude that ghosting effects cannot be accurately included in a revised predictive, distant network signal eligibility standard at this time and that the suggested on-site multipath measurements cannot be made in an inexpensive and simple manner. Nonetheless, we point out that our ILLR measurement methodology, which is the subject of another

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[193] Network Affiliates Joint Reply at 42 (citing antennas made by Channel Master and Winegard, and circuits made by Oren Semiconductor).

[194] MSTV Reply at 7-10.

[195] MSTV Reply at 7, citing EchoStar Comments at 25. *See also* Network Affiliates Joint Reply, Exh. 1 (Further Engineering Statement) at 13 ("EchoStar mentioned LULC classifications in its comments, but this data is far too coarse to model these [multipath] variables.").

[196] EchoStar Reply at 6-7.

[197] EchoStar Comments at 26 (emphasis added).

[198] *See* 145 Cong. Rec. H12813 (daily ed. Nov. 18, 1999) (statement of Rep. Coble); 145 Cong. Rec. S15020 (daily ed. Nov. 19, 1999) (statement of Sen. Leahy).

proceeding,[199] does account for land use and land cover, which are physical aspects that do relate to the extent of multipath interference at particular locations.[200] Finally, we stress that efforts taken by consumers to use and properly orient antennas designed to ameliorate multipath interference will go a long way to minimize the ghosting phenomenon. Therefore, we conclude that insufficient information has been submitted to support any recommendation for an addition to or modification of the existing planning factors to account for multipath interference.

60. *Replacement of Grade B Standard.* The *NOI* recognized that it is possible that adoption of an alternative standard, rather than a modification of the current Grade B field intensity standard, may be the more appropriate way of determining satellite TV subscriber eligibility for reception of distant network signals.[201] Therefore, we sought comment on alternative analog TV standards for purposes of determining distant network signal eligibility. We asked commenters who recommend alternative ways of determining satellite TV subscriber eligibility for reception of distant network signals to explain the technical justification for their proposal and include a methodology of predicting eligibility and verification of such predictions. We emphasized that all comments should be substantiated with a technical showing and should explain why any recommended alternative standard is superior to the current Grade B approach. No comments suggested the outright replacement of the Grade B planning methodology. Thus, we find that the record does not support, for the purpose of determining distant network signal eligibility, the replacement of the current methodology used to construct the Grade B signal intensity standard with an alternative methodology.

61. *Eligibility Standard for DTV Signals.* As explained in the *NOI,* Section 73.622(e) of our Rules defines the Digital Television (DTV) service area as the geographic area within which the predicted F(50,90) field strength of the station's signal exceeds: 28 dB/μv/m for low VHF channels; 36 dB/μv/m for high VHF channels; and 41 dB/μv/m for UHF channels.[202] These values are the levels at which reception of DTV service is limited only by receiver and channel noise. Within the contours established by these values, service is considered available at locations where the station's signal strength, as predicted using the terrain dependent Longley-Rice point-to-point propagation model, exceeds these values.[203] These values, in turn, are based on the DTV planning factors shown in the table below.

DTV Planning Factors

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[199] *See Establishment of an Improved Model for Predicting the Broadcast Television Field Strength at Individual Locations,* ET Docket No. 00-11, *Notice of Proposed Rulemaking,* FCC 00-17, released January 20, 2000, *First Report and Order,* FCC 00-185, released May 26, 2000.

[200] *See SHVA Report and Order,* 14 FCC Rcd 2654 at ¶ 83.

[201] *NOI* at ¶ 28.

[202] *NOI* at ¶ 29.

[203] 47 CFR §73.622(e)(2).

Factors	Units	Channels 2-6	Channels 7-13	Channels 14-69
1. Thermal Noise @ 75 ohms	dB/1μv	1.75	1.75	1.75
2. Receiver Noise Figure	dB	10	10	7
3. Signal to Random Noise Ratio	dB	16	16	16
4. Transmission line loss	dB	1	2	4
5. Receiving Ant. Gain	dB	4	6	10
6. Dipole Factor	dB	3	12	22
7. Local Field	dB/1μv/m	28	36	41
8. Terrain Factor (50%)	dB	0	0	0
9. Time Fading Factor (90%)	dB	0	0	0
10. Median Field F(50,50)	dB/1μv/m	28	36	41
11. To overcome Urban Noise	dB	0	0	0
12. Required Field	dB/1μv/m	28	36	41

It should be noted that the time fading factors for DTV are not included in the determination of the DTV minimum field intensities. Therefore, time fading factors must be added to the minimum required field intensities to obtain values for median field intensities when making field strength measurements. The accountability for time fading should also be included in the field strength prediction methodology.

62. We also pointed out in the *NOI* that the planning factors for digital television are the same physical factors which to date have been generally considered to influence the quality of reception of over-the-air transmissions of analog television pictures by home audiences, *e.g.*, thermal and receiver noise, signal-to-noise ratio, transmission line loss, antenna gain/dipole factor, and propagation variability factors.[204] Therefore, we sought comment on whether the existing DTV noise-limited service contour values are also valid for the purpose of determining whether a DTV viewer is eligible to receive satellite transmissions of distant network signals under the *SHVIA*. If not, we asked for comment on which specific modifications to this standard should be made. We emphasized that comments should be supported with a sound technical justification. Additionally, we sought comment on an alternative DTV standard for purposes of determining distant network signal eligibility.

63. The clear consensus of commenters is that it would be premature for the Commission to recommend any particular eligibility standard for distant network DTV signals.[205] We agree. At this point in time, there is an insufficient body of evidence to indicate whether the current DTV planning factors, upon which the DTV service areas are based, are appropriate for the purpose of *SHVIA*. Additionally, there is not a compelling need to set a standard at this time. We conclude that the wisest course is to defer suggesting a particular distant network signal eligibility standard for DTV until such time as it becomes clear that such a standard is actually needed and what the appropriate *SHVIA* standard should be.

64. *Conclusion and Recommendation to Congress.* Based on the record developed through our inquiry process, we recommend to the Congress that the Grade B signal intensity standard be retained for determining whether a household is eligible to receive retransmitted distant TV network signals. However we are recommending a change in the values of the Grade B signal intensity standard, solely for the purpose of determining distant network signal eligibility, to reflect a change in the method of determining

[204] *NOI* at ¶ 30.

[205] See MSTV Comments at 24-25; NAB Comments at 56-57 & Reply at 14-15; Network Affiliates Comments at 21-22; SBCA Comments at 8; and EchoStar Reply at 3-4 & n.6.

the values of the time fading planning factor. We also recommend that the construction of a distant network signal eligibility standard for DTV be deferred until such time as it becomes clear that such a standard is actually needed and what the appropriate standard should be.

65. As to the nine basic Grade B planning factors used to construct the existing distant network signal eligibility standard for analog TV, we find that the current values of six of these factors to be specifically appropriate: thermal noise; transmission line loss; receiving antenna gain; dipole factor; terrain factor; and urban noise. With regard to the three remaining factors, signal-to-noise ratio, time fading, and receiver noise figure, there is some potential for improvement which could increase the "accuracy" of these predictive factors. However, we also believe that while the changes to the signal-to-noise ratio factor based on picture acceptability by 90 percent of observers would tend to increase the required signal intensity for reception, the changes to the receiver noise figure based on the expected improvements in modern television receivers would tend to lower the required signal intensity by a roughly equivalent degree. Studies necessary to arrive at new values for signal to noise ratio and receive noise figures would be very costly and would take considerable time to complete. In as much as the results of these studies would almost surely be offsetting, we therefore do not recommend any changes to the signal-to-noise ratio and receiver noise figure planning factors.

66. Finally, with regard to the time fading factor, we believe that the time fading values determined for the actual receiving location by the Individual Location Longley-Rice prediction model should be substituted for the existing values. This modification to the time fading factor could have two opposing effects on the total number of households deemed by *SHVIA* to be unserved. On the one hand, it might increase the number of households located within the outer portion of coverage areas of maximum facility stations who are deemed unserved. For maximum facility VHF stations, the predicted number of unserved households in the outer 2 to 3 miles of the traditional Grade B coverage area would tend to increase. For maximum facility UHF stations, up to about the outer 7 miles of the traditional coverage area might be similarly affected. On the other hand, the tendency would be opposite for the stations' close-in, difficult reception areas. At these locations the predicted number of unserved households could decrease under this modification. However, we believe that the number of newly predicted served locations in close-in, difficult reception areas will be very small compared to the number of newly predicted unserved locations in the outer edges of station coverage. In any event, the modification would improve the accuracy of the Grade B standard for *SHVIA* purposes. Therefore, we recommend that the time fading planning factor be modified to replace the existing fixed values with the distance-sensitive values determined for the actual receiving locations using the Individual Location Longley-Rice prediction model.

67. We also have considered an additional planning factor for multipath interference that was suggested by commenters, and do not recommend including such factor in the distant network signal eligibility standard. We found that the effects of ghosting cannot be effectively included in a revised distant network signal eligibility standard at this time, because we have been unable to identify a reliable methodology for predicting multipath at an individual location. In addition, on-site measurements that are capable of incorporating multipath interference, as proposed by one of the commenters, cannot be made in an inexpensive and simple manner.[206] A predictive methodology is necessary to keep costs low when

[206] As we stated in the *SHVA Report and Order*, 14 FCC Rcd 2654 at ¶ 45:

> For the SHVA to function properly, a relatively low cost, accurate, and reproducible methodology for measuring the presence of a Grade B intensity signal in a household is of particular importance. Although, because of the costs and delays involved, it would be desirable to minimize the need for individual testing to the extent possible, individual testing is the key safety net mechanism under the SHVA for proving that a specific household is unserved and thus eligible under the law to receive satellite delivery of network affiliated television stations. We

(continued….)

determining the eligibility of satellite television subscribers to receive retransmitted distant signals of network stations under *SHVIA*. We continue to believe that consumer efforts to use and properly orient antennas designed to ameliorate multipath interference is an excellent way to minimize the ghosting phenomenon. In view of the absence of any technical solutions for the inclusion of this impairment, we do not recommend modification of the Grade B signal intensity standard to include multipath interference.

68. Overall, we point out that no new studies that could serve as a scientifically sound basis to revise the distant network signal eligibility standard beyond the above recommendation were offered by the commenters or available from other sources. Much of the material relied upon by the commenters was a resubmission of material that we have previously considered in other proceedings. We also believe that technological developments over the years have led to an increased "safety margin" in television receivers so that the actual quality of reception is probably somewhat better than predicted by the methodology and assumptions underlying the creation of the Grade B signal intensity values. These positive developments have not been studied in sufficient depth or scale as to warrant any decrease in the values of the Grade B signal intensity standard, but they do weigh against increasing those values for any but scientifically supported reasons.

ORDERING CLAUSE

69. IT IS ORDERED that, pursuant to Section 339(c)(1) of the Communications Act of 1934, as amended by the Satellite Home Viewer Improvement Act of 1999, this Report IS ADOPTED. In fulfillment of the provisions of the Satellite Home Viewer Improvement Act of 1999, IT IS FURTHER ORDERED that this Report is to be presented to the Congress.

70. IT IS FURTHER ORDERED that the "Request for Extension of Comment and Reply Comment Dates" filed on July 17, 2000 by J.E. Schmidt IS DISMISSED.

FEDERAL COMMUNICATIONS COMMISSION

Magalie Roman Salas
Secretary

(Continued from previous page)

therefore propose to explore a method of measuring signal intensity at individual households that is accurate, easier, and less expensive than the current method.

Appendix A

List of Commenters

1. Richard L. Biby, P.E. ("Biby"), filed June 26, 2000
2. Satellite Broadcasting and Communications Association ("SBCA"), filed June 27, 2000
3. National Association of Broadcasters ("NAB"), filed June 27, 2000
4. EchoStar Satellite Corporation ("EchoStar"), filed June 27, 2000
5. Association for Maximum Service Television, Inc. ("MSTV"), filed June 27, 2000
6. ABC Television Affiliate Associations *et al.*("Network Affiliates"), filed June 27, 2000
7. Fox Television Stations, Inc. *et al.* ("Fox"), filed June 27, 2000
8. National Rural Telephone Cooperatives ("NRTC"), filed June 27, 2000

Reply Commenters

1. NAB, filed July 12, 2000
2. EchoStar, filed July 12, 2000
3. Network Affiliates, filed July 12, 2000
4. MSTV, filed July 12, 2000
5. Capitol Broadcasting Company, Inc. ("Capitol"), filed July 12, 2000
6. NRTC, filed July 12, 2000

Other

1. J.E. Schmidt filed a request for extension of time to file comments and reply comments, on July 17, 2000