FCC MAIL SECTION

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

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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	)	

NOTICE OF INQUIRY

Adopted: May 22, 2000 **Released: May 26, 2000**

Comment Date: June 27, 2000

Reply Comment Date: July 12, 2000

By the Commission:

1. In this proceeding, we are opening an inquiry to obtain information for evaluating whether the signal intensity standard used to determine the eligibility of satellite television subscribers to receive retransmitted distant signals of network stations should be modified or replaced. The existing standard uses the Grade B signal intensity values that have long been used within the television broadcast service.[1] We are not considering alteration of the Grade B standard for any purpose other than determining eligibility to receive retransmitted distant network signals. We seek information and comment in this Notice of Inquiry on all technical parameters that scientifically could be considered to affect the quality of over-the-air reception of television pictures. We also seek information and comment on an appropriate eligibility standard for digital signals. Based on the record that will be developed, we will submit our findings on this issue to the Congress. We initiate this proceeding in response to the recently enacted Satellite Home Viewer Improvement Act of 1999 (*SHVIA*).[2]

[1] *See* Section 73.683 of the Commission's Rules, 47 C.F.R. § 73.683.

[2] *See* Consolidated Appropriations Act for 2000, Pub. L. 106-113, § 1000(9), 113 Stat. 1501 (enacting S. 1948, including the Satellite Home Viewer Improvement Act of 1999, Title I of the Intellectual Property and Communications Omnibus Reform Act of 1999, relating to copyright licensing and carriage of broadcast signals by satellite carriers, codified in scattered sections of 17 and 47 U.S.C.). 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.*

BACKGROUND

2. The broadcast television industry has the right, through the Copyright Act[3] and private contracts, to control the distribution of the national and local programming that it transmits.[4] In 1988, Congress adopted the Satellite Home Viewer Act (*SHVA*) as an amendment to the Copyright Act in order to protect the broadcasters' interests while simultaneously enabling satellite carriers to provide broadcast programming to those satellite subscribers who are unable to obtain broadcast network programming over-the-air. 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,"[5] the Commission adopted rules for determining whether a household is able to receive a television signal of this strength.[6] 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.[7] 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.[8]

3. *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 Commission-defined measure of the strength of a given television station's over-the-air signal.[9] This standard was developed in the early days of television as a key component of the Commission's channel allotment protocol.[10] Generally, if a household receives a television signal of Grade B intensity, it should receive an acceptable television picture at least 90% of the time.[11] 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

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[3] 17 U.S.C. § 119. The Satellite Home Viewer Act is part of this copyright statute.

[4] *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*").

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

[6] *SHVA Report and Order* at ¶ 4, *supra* note 4.

[7] *Id.* at ¶ 8.

[8] 47 C.F.R. § 73.622(e). *See also* 47 C.F.R. § 73.625(b) (determining coverage).

[9] 17 U.S.C. § 119(d)(10)(A); 47 C.F.R. § 76.683.

[10] *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 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*").

[11] *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*").

provide 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.[12] The Grade B signal contour is used to define a television station's service area.

4. The Grade B contours (which represent the required field strength in dB above one microvolt 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.[13] Section 73.686 describes a procedure for making field strength measurements.[14]

5. 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 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). 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 account for this variability and, therefore, as indicated above, predict that at least 50% of the locations along the Grade B contour will receive an acceptable picture 90% of the time.[15]

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[12] 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. *See also* NAB Comments Attachment C, Jules Cohen Statement, at 2 and Network Affiliate Associations Comments at 3 and n. 110.

[13] 47 C.F.R. § 73.684.

[14] 47 C.F.R. § 73.686.

[15] 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 4, 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.

6. The "acceptable quality" contemplated when the Grade B standard was developed was based on picture quality levels used by the Television Allocation Study Organization ("TASO").[16] 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."[17] 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. 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.[18]

7. *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."[19] This measure was not, however, created for evaluating service quality in individual households. Rather, the system 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."[20] *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]."[21] For *Grade B* service, acceptable service is expected 90 percent of the time at 50 percent of the locations. The service areas were 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."[22] The signal intensity values (also referred to as "field strengths") were determined based on certain assumptions, which 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.[23]

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

[17] See O'Connor, *supra* note 11. The interference referred to here was from random noise.

[18] 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.

[19] *See* Section 73.683(a) of the Commission's Rules, 47 C.F.R. § 73.683(a).

[20] TV Allocations *Third Notice, supra* note 10, 16 Fed. Reg. at 3075.

[21] *Id.*

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

[23] 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.

DISCUSSION

8. The recently enacted *SHVIA* revises and extends the statutory provisions of the *SHVA*. With regard to the signal standard used for satellite carrier purposes, *SHVIA* adds a new section 339(c)(1) to the Communications Act of 1934, as amended.[24] Pursuant to this new section, the Commission must conduct an inquiry to evaluate all possible standards and factors for determining eligibility for retransmissions of network station signals. If appropriate, the Commission is to recommend modification, or alternative standards or factors, to the Grade B intensity standard for analog television signals set forth in 47 C.F.R. § 73.683(a) and to make a further recommendation relating to an appropriate standard for digital television signals. Our goal in this inquiry is to identify more accurately, and consistent with the *SHVA*, those consumers who can and cannot receive their local television network stations over-the-air.

9. We will begin our discussion by reviewing the technical factors used to develop the Grade B standard. We then will discuss some modifications to those factors that may be useful in developing a new or modified signal intensity standard that could serve as an eligibility criterion for distant TV network signal reception. Nonetheless, as Section 339(c) indicates, there may be "alternative standards or factors," of which we are currently unaware, that may be superior to the existing methodology for determining signal intensity standards. Therefore, in addition to seeking comment on how a signal intensity standard should be derived from the methodology employed to develop the Grade B standard, we seek comment as to what alternative standards or factors would prove superior to such standards for the purpose of determining eligibility under *SHVIA*. Finally, we seek information and comments on establishing an appropriate eligibility standard applicable to digital television (DTV) signals. In all cases, we request commenters to submit a substantive technical justification for their proposals. Where alternative standards are proposed, commenters should include in their technical showing a methodology for predicting eligibility and for verifying such predictions and should provide information on the accuracy and costs of the prediction model proposed.

10. *Modification of the Grade B Standard.* In paragraph 7 above, we observed that the Commission's television broadcast service rules refer to Grade A and Grade B field intensities, which are based on different assumptions. Grade A service areas assume an urban or suburban environment and take into account environmental man-made electrical noise. Grade B service areas, unlike Grade A service areas, include rural areas and presuppose the use of larger, directional receiving antennas. The planning factors used in deriving the Grade A and B field intensity values for analog TV service are shown in the following tables.

[24] 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 C.F.R. § 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."

Table 1. Grade A 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	0	0	8
6. Dipole Factor	DB	-3	6	16
7. Local Field	dB/1μv/m	47	57	65
8. Terrain Factor (70%)	DB	4	4	6
9. Time Fading Factor (90%)	DB	3	3	3
10. Median Field F(50,50)	dB/1μv/m	54	64	74
11. To overcome Urban Noise	DB	14	7	0
12. Required Median Field	dB/1μv/m	68	71	74

Table 2. 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

11. We seek comment on whether there have been any technological developments in television system equipment, over-the-air television viewer installations or picture quality expectations that would warrant a significant modification to the planning factors on which the current Grade B standard for household eligibility for distant TV network signal reception under *SHVA* is based. Also, are any of the planning factors for Grade A more appropriate than the corresponding Grade B factors for determining distant signal reception eligibility? Comments should be supported by technical showings evidencing the need to make the suggested changes. In addition, we invite the submission of evidence that documents any significant changes in the television reception environment, and significant changes in viewer expectations, that have not been documented in previous Commission proceedings. In this regard, analog TV Table 2 above, identifies all of the physical factors which to date have been generally

considered to influence the quality of television pictures viewed by home audiences through the reception of over-the-air transmissions. In this inquiry, we intend to re-examine each of these factors to determine if the current values for the analog Grade B field intensity standard are valid for the purposes of determining whether a satellite TV subscriber is eligible to receive transmissions of distant network signals under the *SHVA*.[25] We now specifically discuss some of the key factors about which commenters may wish to submit further technical analysis.

12. *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 "signal budget." The choice of an adequate signal budget that accounts for the overall noise level that must be overcome is necessary in designing TV sets. In the 1950s low cost electronic technology for television frequencies was not commonly available initially. Television tuner technology then consisted of noisy, low cost tubes and related components. Therefore, the figure initially used for the receiver noise planning factor was chosen to minimize costs for TV set manufacturers, so as to ensure that television sets would be affordable by the public. Today, however, TV tuner technology has progressed dramatically from those early days in TV history, and tuners contain modern solid state components that produce lower set noise. Thus, in MM Docket No. 87-268, dealing with the planning factors for DTV, the Commission recognized that receivers have in many cases improved beyond the current Commission requirements[26] and will probably get even better in the future. In that proceeding, for the purpose of allotting DTV channels, the Commission used noise figure planning factors for DTV receivers that, for the UHF band of operation, are some 7 dB better than the current requirement set forth in Section 15.117 of our rules.

13. We ask for comment on whether the television receiver noise figures used in the planning factors shown in Tables 1 and 2 are still valid for the average television receiver employed in the home today. If not, what values should be used and are these new values substantiated by technical data? Have advances in the technology of television receivers, at minimum, kept pace with today's consumer expectations for better reception of television service?

14. *Signal-to-Noise Ratio and Service Quality.* "Signal-to-Noise Ratio", in the context here, is the ratio of the amplitude of the signal after detection in the receiver to the amplitude of the noise accompanying the 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 snow is visible. We note that comments submitted in the *SHVA Proceeding* urged recognition that, for many people, the existing Grade B signal intensity values no longer equate to truly acceptable picture quality. In other words, the commenters suggested that viewers' expectations as to what level of signal quality is "acceptable" have 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 have indeed changed, no current study documents this purported change or replicates the methodology of the initial TASO study that correlated

[25] We note that, in the proceeding to develop an appropriate Individual Location Longley-Rice (ILLR) predictive model for field strength at individual locations, pursuant to *SHVIA,* we are considering related signal propagation factors. *See Establishment of an Improved Model for Predicting the Broadcast Televison Field Strength Received at Individual Locations,* ET Docket No. 00-11, *Notice of Proposed Rulemaking,* FCC 00-17, released January 20, 2000, at ¶¶ 6-12.

[26] *See* Section 15.117 of the Commission's Rules, 47 C.F.R. § 15.117 (TV receiver requirements).

viewer judgments of television picture quality with specific signal levels.[27] Some research on subjective evaluations of television pictures may show that viewers have raised their level of expected performance, but the results of any subjective testing are dependent on the testing methodology and conditions. For example, several recent tests were conducted by cable television sponsors using as subjects viewers who may have expected to receive, and to pay for, higher quality pictures.[28] Those subjects, however, may not be representative of audiences relying on over-the-air reception for their television viewing. Nonetheless, one of the specific purposes of this inquiry is to ascertain whether the signal intensity standard for *SHVA* purposes needs to be updated to reflect consumers' current expectations of what is acceptable picture quality.[29] Thus, the results from an updated study of viewer expectations based on scientifically valid methods, such as ITU Recommendation 500-4,[30] could be valuable in this regard.

15. We request 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 *SHVA* purposes. Should television pictures received by over-the-air reception be comparable to those received from satellite when developing an eligibility standard for *SHVA* purposes? Have there been any current studies made of today's home television viewer expectations of picture quality using scientifically valid subjective methods? If so, what are the results of these studies?

16. *Transmission Line Loss and Antenna Gain.* 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 less 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. 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.

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[27] 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, 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, "Method for the Subjective Assessment of the Quality of Television Pictures," *infra* note 28. Neil Smith acknowledged that his sample was too small to be sufficient for any generalizations. See *id.*, Neil Smith Study at 18-19. The Charlotte study did not use study subjects from the general public and viewing conditions were not appropriate for a scientific study.

[28] Recommendation 500-4, "Methods for Subjective Assessment of Picture Quality of Television Pictures," Recommendations and Reports of the CCIR, Vol. XI, Part 1, Dubrovnik, 1986, and Subjective Assessment of Cable Impairments on television Picture Quality, Bronwen Lindsay Jones, 1992 NCTA Technical Papers.

[29] See Letter to Chairman, FCC from Senator McCain and Representatives Bliley, Oxley, and Markey, dated December 8, 1999.

[30] *See* Recommendation 500-4, *supra* note 28.

17. We request comment regarding the appropriateness of the receiving antenna system gains and losses set forth in Tables 1 and 2 for today's analog television reception. Because reception of satellite delivered television is generally based on the installation of a directional outdoor antenna, we ask 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 request comment regarding the appropriateness of assuming an outdoor, directional gain antenna model for over-the-air reception of television when determining eligibility under *SHVA*. We also seek comment on whether there have been more current studies of typical home television receiving installations than the one cited in the paragraph above. If so, how extensive were these studies and what are the results?

18. 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."[31] We seek 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 *SHVA* eligibility, how should the antenna gain be modified for those network stations not in the center of the main beam of a stationary directional antenna? Which station location should be considered the pointing direction of the antenna when making such determinations?[32]

19. *Dipole Factor.* Another 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 current Grade B planning factors are based on dipole factors determined at the geometric mean frequency of each of the three television bands. 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.[33] For the purpose of achieving consistent service replication data for DTV, this same methodology was used to

[31] 17 U.S.C. § 119(d)(10)(A) as amended by SHVIA § 1005(a) (emphasis added).

[32] We note that the *SHVIA* requires a determination of household eligibility for each network station considered individually. That is, 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.

[33] 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.

modify the Grade B field strength values (set forth in 47 C.F.R. § 73.683) applicable to existing analog UHF stations.[34] 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.

20. We seek comment on whether the modifications to the dipole factor applied to the DTV planning factors should be extended to also apply to modification of the analog television Grade B standard for the purposes of *SHVA*. We also ask 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.

21. *Field Strength Variability.* VHF and UHF field intensities vary not only with time, but also with location. 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. This variation is 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.[35] 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.

22. We seek comment on the appropriateness of the field strength variability factors used in the Grade B field intensity standard when determining eligibility under *SHVA*. Because *SHVA* eligibility is determined by use of the ILLR propagation predictive model for individual locations, we ask if the current location variability factor used in the Grade B standard is appropriate.[36] We also seek comment on the appropriateness of the field strength time variability factor used in the Grade B standard when determining eligibility under *SHVA*. In other words, is the prediction of an acceptable picture at least 90% of the time an inadequate standard for the average television viewer? We seek 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 *SHVA* eligibility. In addition, in those cases where comments support a time variability factor for signal levels greater than the 90th percentile, we seek information regarding the availability of propagation data that clearly supports the proposed value of time variability.

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[34] 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.

[35] See discussion at ¶ 5 n.15 supra.

[36] We note that the "50% of locations" factor was intended to produce a contour that identifies the edge of a TV service area. For *SHVA* purposes, however, contours are irrelevant and what instead matters is TV reception at each household considered individually. Thus, in the *SHVIA* ILLR Proceeding, ET Docket No. 00-11, *supra* note 25, the Commission is considering an ILLR model for determining whether each individual household will, with 50% confidence, receive a Grade B signal.

23. *Environmental Noise.* Environmental noise is generated by noise sources external to the receiver 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. External noise can be divided into several categories. Usually, external noise is categorized according to whether it is of atmospheric, galactic, or man-made origin. Since atmospheric noise usually predominates at frequencies below 30 MHz, it generally disturbs only the television reception 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.

24. We seek comment on whether the planning factor values currently used to account for environmental noise levels values (*i.e.*, planning factor 11 in Table 2) are appropriate for a standard to determine *SHVA* eligibility. For example, have environmental noise levels increased (or decreased) and, if so, how should this affect any *SHVA* eligibility standard? We seek 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 *SHVA* eligibility.

25. *Multipath Interference.* 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. 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 building 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.

26. 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.[37] Although ghosting is one of the most serious causes of poor picture

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

quality or loss of service in television reception, no significant studies of television picture impairment by ghosting have been made, except in the case of relatively simple, single ghost images.[38] However, in most cases, ghost images are multiple and complex. Simply expressing the desired-to-undesiredsignal 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 signal standard for *SHVIA*, 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. We seek comment on whether the eligibility standards should account for ghosting and, if so, what methods and values should be used. Are there scientifically accepted models for predicting ghosting that should be used in determining eligibility standards?

27. We seek comment on whether the effects of multipath interference should be included in the eligibility standards. If so, how should they be accounted for? Should the eligibility standards presume that the viewer will act to minimize ghosting and, if so, what viewer actions should be presumed, and how should the standards account for those presumptions? We also seek information regarding the results of any technical studies of television picture impairment by ghosting. Such studies should include quantitative measures of multiple ghosts correlated with a subjective evaluation of the resultant impairment.

28. *Replacement of the Grade B Standard.* We recognize 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. Therefore, we seek comment on an alternative analog TV standard for purposes of determining eligibility pursuant to *SHVA*. Commenters who recommend alternative ways of determining satellite TV subscriber eligibility for reception of distant network signals should explain the technical justification for their proposal and include a methodology of predicting eligibility and verification of such predictions. 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.

29. *Eligibility Standard for Digital Television Signals.* 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, expressed in dB/μv/m, exceeds the levels shown below in Table 3. The values shown 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.[39] These values, in turn, are based on the DTV planning factors shown below in Table 4.

[38] 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.

[39] 47 C.F.R. §73.622(e)(2).

Table 3. DTV Service Area Contours

	DB/μv/m
Channels 2-6	28
Channels 7-13	36
Channels 14-69	41

Table 4. DTV Planning Factors

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.

30. It should also be noted that the planning factors in Table 4 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. Therefore, we seek comment in this inquiry regarding whether the DTV noise-limited service contour values shown in Table 3 above are valid for the purposes of determining whether a DTV viewer is eligible to receive satellite transmissions of distant network signals under the *SHVA*. If not, what specific modifications to this standard should be considered? Comments should be supported with a sound technical justification. Additionally, we seek comment on an alternative DTV standard for purposes of determining eligibility pursuant to *SHVA*.

PROCEDURAL MATTERS

31. *Ex Parte Status of Proceeding.* Subject to the provisions of 47 C.F.R. § 1.1203 concerning "Sunshine Period" prohibitions, this proceeding is exempt from *ex parte* restraints and disclosure

requirements, pursuant to 47 C.F.R. § 1.1204(b)(1).

32. *Filing of Comments and Reply Comments.* Pursuant to Sections 1.415, 1.419, and 1.430 of the Commission's rules, 47 C.F.R. §§ 1.415, 1.419, 1.430, interested parties may file comments on or before **June 27, 2000**, and reply comments on or before **July 12, 2000**. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS) or by filing paper copies. *See Electronic Filing of Documents in Rulemaking Proceedings,* 63 Fed. Reg. 24,121 (1998).

33. Comments filed through the ECFS can be sent as an electronic file via the Internet to http://www.fcc.gov/e-file/ecfs.html. Generally, only one copy of an electronic submission must be filed. In completing the transmittal screen, commenters should include their full name, Postal Service mailing address, and the applicable docket number. Parties may also submit an electronic comment by Internet e-mail. To get filing instructions for e-mail comments, commenters should send an e-mail to ecfs@fcc.gov, and should include the following words in the body of the message, "get form <your e-mail address>." A sample form and directions will be sent in reply.

34. Parties who choose to file by paper must file an original and four copies of each filing. All filings must be sent to the Commission's Secretary, Magalie Roman Salas, Office of the Secretary, Federal Communications Commission, 445 12th Street, S.W., Room TW-A325, Washington, D.C. 20554.

35. Parties who choose to file by paper should also submit their comments on diskette. These diskettes should be submitted to: Charles J. Iseman, Deputy Chief, Electromagnetic Compatibility Division, Office of Engineering and Technology, Federal Communications Commission, The Portals, 445 Twelfth Street, S.W., Room 7-A363, Washington, D.C. 20554. Such a submission should be on a 3.5-inch diskette formatted in an IBM-compatible format using Word for Windows or compatible software. The diskette should be accompanied by a cover letter and should be submitted in "read only" mode. The diskette should be clearly labeled with the commenter's name, proceeding (including the docket number, in this case **ET Docket No. 00-90**, type of pleading (comment or reply comment), date of submission, and the name of the electronic file on the diskette. The label should also include the following phrase, "Disk Copy – Not an Original." Each diskette should contain only one party's pleadings, preferably in a single electronic file. In addition, commenters must send diskette copies to the Commission's copy contractor, International Transcription Service, Inc., 1231 20th street, N.W., Washington, D.C. 20036.

36. Comments and reply comments will be available for public inspection during regular business hours in the Reference Information Center (Room CY-A257) of the Federal Communications Commission, The Portals, 445 Twelfth Street, S.W., Washington, D.C. 20554. Copies of comments and reply comments will also be available through the Commission's duplicating contractor, International Transcription Service, Inc. (ITS, Inc.), 1231 20th Street, N.W., Washington, D.C. 20036, (202) 857-3800, TTY (202) 293-8810.

37. Alternative formats (computer diskette, large print, audiocassette and Braille) are available to persons with disabilities by contacting the Consumer Information Bureau, Consumer Education Office, at (202) 418-2514, TTY (202) 418-2555, or at fccinfo@fcc.gov. The *Notice* can also be downloaded at www.fcc.gov/dtf/.

38. *Additional Information.* For additional information regarding this proceeding, contact Charles J. Iseman, Deputy Chief, Electromagnetic Compatibility Division, Office of Engineering and Technology, at 202-418-2444 or ciseman@fcc.gov.

ORDERING CLAUSE

39. 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 Notice of Inquiry IS ADOPTED.

FEDERAL COMMUNICATIONS COMMISSION

Magalie Roman Salas

Magalie Roman Salas
Secretary