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

In the matter of	)	
Establishment of an improved Model for	)	
Predicting the Broadcast Television Field	)	ET Docket No. 00-11
Strength Received at Individual Locations	)	

REPLY COMMENTS OF POTOMAC INSTRUMENTS, INC. ON NOTICE OF PROPOSED RULEMAKING

About the Commenter

Potomac Instruments, inc., ("**PI**") and its lineal predecessors have, for more than fifty years, been actively engaged in the design, development and manufacture of precision test and measurement equipment. Our equipment is developed, specifically, for the purpose of quantifying various technical parameters that pertain to radio and television broadcast signals. VHF and UHF Field Strength[1] Meters and their attendant calibrated dipole antennas are among the instruments that we design and manufacture. Members of the international broadcast engineering community and appropriate government regulatory agencies routinely use these devices as traceable portable measurement standards. Although we do not presume to be expert in the area of predictive radio wave propagation modeling, we do claim a certain expertise relating to the nuances of collecting accurate television field strength data and to the instrumentation requirements pertaining thereto. It is from this perspective that we offer our reply comments in support of the Commissions' continuing efforts to develop and refine a truly reliable mathematical model for the presumptive determination of received terrestrial television broadcast signals at specific locations.

Introduction

The 21st century dynamic of the exponential rate of convergence of telecommunications technology acting in conflict with regulatory policy implementation inertia is, nowhere, more evident than in this proceeding. In response to public demand for satellite access to copyrighted program material the Commission has recommended and Congress has, in turn, mandated the use of a predictive point to point propagation computer model . Accordingly, the Individual Location Longly-Rice, (ILLR) model will, by statutory rule, within 180 days of the enactment of the authorizing legislation,[2] and

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[1] The National Institute of Standards and Technology (NIST) has determined that the term "field strength" relates specifically to the voltage component of field power which is, in turn, referred to as "field intensity."
[2] See Satelite Home Viewer Improvement Act of 1999 ("SHIVA")

without full endorsement of the technical and scientific community, become the presumptive determinate for Grade B [3] terrestrial signal intensity threshold. Further, Congress has mandated that the Commission designate “Neutral and Independent Entities” capable of resolving individual challenges of the statistically derived “unserved household” [4] by means on onsite measurement.

The following table depicts Grade B compliant median F(50,50) field strength contours defined in section 73.683 of the FCC rules:

	Grade B Field Strength	
	MV/M	dBuV/M
Channels 2 - 6	0.2	47.0
Channels 7 - 13	0.6	56.0
Channels 14 – 83	1.6	64.0

In this proceeding the Commission acknowledges that the determination of Grade B television signal coverage at any specific location is not a simple task and they suggest that the model will be refined over time.

In the computational domain, ILLR faces numerous challenges and nuances relating to the adoption of technically sound modeling variables as illustrated by various commenters in this proceeding. Further, the Commission specifically acknowledges in ¶8 of this proceeding that the input parameters of the ILLR model differ from those used for determining DTV [5] coverage using the same version (1.2.2) of the Longley-Rice model. Considering the fact that network owned and operated terrestrial broadcast facilities have been among the first to construct mandated DTV facilities, these differences, alone, may accelerate the need to revisit and further refine the operational predictive model. In the physical measurement domain, the process of accurately determining VHF and UHF field strength requires skilled use of proper equipment by knowledgeable personnel. Test data can be easily corrupted if the instrumentation is not properly calibrated or the technician is not properly schooled in free space radio frequency measurement methodology.

<u>National Television System Committee (NTSC) measurements</u>

An NTSC picture is most often evaluated on the basis of "graceful degradation" due to an ever increasing video artifact that stems from random noise, man made noise, RF interference, and other propagation anomalies as distance (from the TV transmitter) is

[3] See 47 CFR, §73.683(a)
[4] An “unserved household” is a household that cannot receive a over-the-air broadcast signal of Grade B intensity from a primary network affiliate through the use of a conventional, stationary, outdoor rooftop, receiving antenna.
[5] DTV refers to any technology that uses digital techniques to provide advanced television services such as High Definition TV (HDTV), multiple standard definition TV (SDTV), and other advanced features and services.

increased. FCC Technical Standards imply an approximate relationship between picture quality and inverse distance field strength.

Field Strength measurements have been a fact of life in NTSC broadcasting from the beginning, as a means of propagation analysis, as a means of showing the level of service to a community, and as a means of showing interference levels. FCC Rules Sec. 73.686 sets out detailed requirements and procedures for these measurements, including the well-known "100-foot run" to highlight multipath effects and other propagation phenomenon. The field strength component to be measured is that of the visual carrier, measured at its peak amplitude during the synchronizing signal. A tuneable, narrow-bandwidth voltmeter must be used; it must be tuneable and narrow-band to reject unwanted signals but wide enough in bandwidth to allow the synchronization pulse to reach peak amplitude. A baseband peak detector holds the peak amplitude long enough for measurement. Examples of such instruments are the **PI** FIM-71 Field Strength Meter for VHF and the FIM-72 for UHF. For the measuring antenna, the only FCC mandated requirements are that it be for horizontal polarization and that it have calibration data. A half-wave dipole with direct NIST calibration, such as the Potomac ANT-71 (VHF) and ANT-72 (UHF), is normally used.

The time constraints associated with this proceeding, as mandated by Congress, permit very little latitude for process development. Accordingly, we concur with the recommendations of the Association of Federal Communications Consulting Engineers (AFCCE) that the Television Allocation Study Organization (TASO) data base while not perfect, provides more relevant clutter loss data, for the ILLR model than would the Rubinstein / Okumura derived data involving vertically polarized land mobile measurements.

Further, we believe that the TASO data has been gathered over an extended period of time and it, therefore, represents a very useful knowledge base that can be easily built upon for the simultaneous purposes of computer model refinement and conflict resolution. We also believe that the measurement techniques that were used for TASO data collection have been carefully considered over time and that they are widely understood and well documented. Accordingly, we recommend that Part 73, § 73.686 of the FCC Rules and Regulations be reviewed and edited, as necessary, to create a framework for a uniform measurement template for SHVIA data gathering. Toward that end, we have extracted (*in italics*) certain portions of the existing rules and have interspersed our comments for consideration as follows:

§ 73.686 Field strength measurements.

(a) *Persons making field strength measurements for formal submission to the Commission in rulemaking proceedings, or making such measurements upon the request of the Commission, shall follow the procedure for making and reporting such measurements outlined in paragraph (b) of this section. In instances where a showing of the measured level of a signal prevailing over a specific community is appropriate, the* *procedure for making and reporting field strength measurements for this purpose is set forth in paragraph (c) of this section.*

(b) Collection of field strength data for [individual location] *propagation analysis.*

(1) Preparation for measurements. (i) On large scale topographic maps, [point to point lines] *are drawn from the transmitter location to the* [measured receiving point.]

(ii) [deleted]

(2) Measurement procedure. The field strength of the visual carrier shall be measured with a voltmeter capable of indicating accurately the peak amplitude of the synchronizing signal. All measurements shall be made utilizing a receiving antenna designed for reception of the horizontally polarized signal component, elevated [6 meters (20 feet) above ground for one-story buildings and] *9.1 meters (30 feet)* [above ground for buildings taller than one-story.] *At each measuring location, the following procedure shall be employed.*

(i) The instrument calibration is checked.

(*ii) The antenna is elevated to* [the appropriate height for the site being measured.]

(iii) The receiving antenna is rotated to determine if the strongest signal is arriving from the direction of the transmitter.

(iv) The antenna is oriented so that the sector of its response pattern over which maximum gain is realized is in the direction of the transmitter.

(v) [deleted]

(vi) The actual measuring location is marked exactly on the topographic map, and a written record, keyed to the specific location, is made of all factors which may affect the recorded field, such as topography, height and types of vegetation, buildings, obstacles, weather, and other local features.

(vii) If, during the test conducted as described in paragraph (b) (2) (iii) of this section, the strongest signal is found to come from a direction other than from the transmitter, additional measurements shall he made in a "cluster" of at least five fixed points. At each such point, the field strengths with the antenna oriented toward the transmitter, and with the antenna oriented so as to receive the strongest field, are measured and recorded. Generally, all points should be within 61.0 meters (200 feet) of the center point of the [receiving location.]

(viii) [deleted]

(3) Method of reporting measurements. A report of measurements to the Commission shall be submitted in affidavit form and should contain the following information:

(i) Tables of field strength measurements, which, for each measuring location, set forth the following data:

(A) Distance from the transmitting antenna.
(B) Ground elevation at measuring location.
(C) Date, time of day, and weather
(D) Median field in dBu for 0 dBk
(E) Notes describing each measuring location.

[In recognition of the realities of current electronic data interchange technology, **PI** believes that the Commission should consider the use of a standardized compilation format for field strength measurement data that is to be submitted for review and action. The proposed format would include the following measurement parameters: (1) the date(s) of the measurement, (2) the azimuth of the radial being measured, (3) distance from the measurement point to the center of the transmitting antenna, (4) measured field strength value, and (possibly) (5) the time of day.

We foresee an increasing reliance upon Global Positioning Satellite ("GPS") technology for time, distance, and bearing information. Inexpensive, readily available, hand-held GPS receivers currently provide direct readout of bearing (reciprocal of radial azimuth) and distance to station thereby aiding in manual data collection today. We believe that any new standardized data format should be capable of accommodating direct importation of certain components of standardized National Maritime Electronics Association ("NMEA") GPS data messages. If this capability is included, then current data collection techniques could be seamlessly merged with future technology which will likely derive data directly from the GPS receiver. Accordingly PI recommends the following format structure:

Field	Description
Dd/mm/yyyy	Date (day, month, year)
hhmmss.ss	UTC time in hours, minutes, seconds
ddmm.mmmmm	Latitude in degrees, minutes, and decimal minutes
ddmm.mmmmm	Longitude in degrees, minutes, and decimal minutes
ddd.d	Azimuth in degrees
mmm.mmm	Distance in kilometers
M	Altitude units, M = meters
vv.v	Field Strength in dBuV/M

We understand that, if the suggested format is adopted, conversions will be required when transitioning between current U.S. Geological Survey ("USGS") maps whose coordinates are expressed in degrees, minutes, and seconds and GPS coordinates that are expressed in degrees, minutes, and decimal minutes. We also understand that GPS Standard Positioning Service ("SPS") currently limits horizontal position accuracy to 100 meters because of Department of Defense ("DOD") imposed Selective Availability ("SA") data degradation. However, we believe that GPS notation is the preferred format for the following reasons: (1) DOD has announced its future intent to disable SA in the GPS satellite constellation except in the case of national emergency. (2) Virtually all of the field strength measurement data supplied to the Commission in support of a filing will be gleaned from user prepared spreadsheet or database software either of which readily accommodates an automated means for coordinate conversion. (3) Commercial availability of GPS compatible map overlay software is exploding thereby offering the potential for greatly improved DA pattern analytical tools for industry and regulator alike.]

(ii) U.S. Geological Survey topographic maps, on which is shown the exact location at which each measurement was made. The original plots shall be made on maps of the largest available scale. Copies may be reduced in size for convenient submission to the Commission, but not to the extent that important detail is lost. The original maps shall be made available, if requested. If a large number of maps is involved, an index map should be submitted.

(iii) All information necessary to determine the pertinent characteristics of the transmitting installation, including frequency, geographical coordinates of antenna site, rated and actual power output of transmitter, measured transmission line loss, antenna power gain, height of antenna above ground, above mean sea level, and above average terrain.

(iv) A list of calibrated equipment used in the field strength survey, which, for each instrument, specifies its manufacturer, type, serial number and rated accuracy, and the date of its most recent calibration by the manufacturer, or by a laboratory. Complete details of any instrument not of standard manufacture shall be submitted.

(v) A detailed description of the calibration of the measuring equipment, including field strength meters, measuring antenna, and connecting cable.

(vi) [Deleted]

(c) through (c) (3) (vii) [Deleted]

PI concurs with the comments submitted by Richard L. Biby, P.E. in which he questions whether the Grade B signals that were considered acceptable to the median viewer in 1958 would be considered acceptable by the contemporary median viewer. We also believe that it would be technically feasible and scientifically desirable to construct a measurement system that would provide a quantitative analysis of picture quality for purposes of individual location signal coverage. We do not, however, believe that it is practical to expect that a, universally acceptable, picture quality analyzer could be developed, tested and be made generally available within 180 days of SHIVA enactment.

We believe that AFCCE made an excellent proposal regarding the “loser pays” cost allocation and escrowed deposits. Not only would this procedure resolve the issue of the measurement entity’s collection of fees for service rendered from the losing party, it would also introduce an additional element of neutrality into the process. Under the proposed scenario the measurement entity would be paid by an independent third party regardless of the measurement outcome.

We agree with Biby that the process of data collection by means of electronic data acquisition and electronic storage would minimize the possibilities for recording errors and would be conducive to improved signal analysis and data transportability.

We further concur with both Biby and AFCCE that qualified personnel are currently available or could be trained and certified for signal testing purposes. Many of the qualified measurement practitioners are either employees of, or have been trained by, AFCCE members. Most of the individuals or firms who currently possess the requisite knowledge and experience to make “spot” Grade B measurements, either now own or have direct access to, the necessary field strength measurement equipment and 9 meter telescoping masts. We believe that it is unlikely that, as a result of this proceeding, there will be sufficient measurement demand to justify major new capital equipment purchases. Further, because of the technical complexity of the issue, we believe that the costs associated with individual measurements will deter the idle challenge to the ILLR presumptive computer model. That said, we believe that is the responsibility of the terrestrial broadcast industry and its federal regulators to “get it right” by gathering valid scientific data which can form the basis for a robust computer propagation model through an iterative process.