conclusions about the relationship between signal strength and picture quality. First, Mr. Neuman selected Pittsburgh, the hilliest major city in the United States east of the Mississippi River, a location certainly not typical of the large majority of United States cities. In his testimony, Mr. Neuman conceded that he did not know what results he would have obtained if he had done similar studies in other locations. Second, Mr. Neuman had the engineers look at only a very small sample of 15 locations. Third, instead of assuring a random sample that would eliminate any possibility of bias, he instead had the engineers hand-pick the locations to be tested. Fourth, for approximately half the tests, the engineers deliberately pointed the antenna away from the station in question, a procedure which will typically worsen picture quality. Fifth, the engineers did not measure the field strength at the specific locations where the videotapes were made; instead, Mr. Neuman used the median value from a 100-foot run, a value which could be significantly higher or lower than the field strength at the spot where the vehicle was stopped for the purpose of making the video recording. For example, at three of the 15 Pittsburgh locations, the signal intensity ranges over the course of the 100-foot run were between 34.9 dBu and 77 dBu, between 43 dBu and 73 dBu, and between 34 dBu and 86 dBu. These

dBu data are on a compressed, "logarithmic" scale; in arithmetic terms, the high-end values are 30 to 200 times stronger than the low-end values. At the locations where videos were recorded, the signal intensity could be at either extreme or anywhere in between. Mr. Neuman did not have the engineers collect the data that would have answered the question. Sixth, although picture quality ratings are highly subjective and individual, the picture quality ratings were made by only one person. Finally, the picture quality ratings were made from a recording of unknown quality.

13. For all the foregoing reasons, Mr. Neuman cannot derive useful conclusions from his 15-location Pittsburgh study, particularly when the results are compared with the Charlotte channel 53 study with its approximately two hundred locations designed to provide a statistically valid sample free of bias.

Jules Cohen

Jules Cohen, P.E.

June 18, 1997

EXHIBIT 3
Declaration of Jules Cohen

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF FLORIDA

CBS Inc., et al.,	)	
	)	
Plaintiffs,	)	
	)	CIV-Nesbitt No. 96-3650
v.	)	Magistrate Judge Johnson
	)	
PrimeTime 24 Joint Venture,	)	
	)	
Defendant.	)	
	)	

DECLARATION OF JULES COHEN

1. My name is Jules Cohen. I have been a professional engineer with particular emphasis on the fields of broadcasting and signal propagation since the end of 1945 upon my release from active duty as a commissioned officer in the U.S. Navy. I was awarded the degree of Bachelor of Science in Electrical Engineering by the University of Washington (Seattle) in 1938. My initial employment in the field of broadcasting was as a Senior Engineer in the consulting firm of Weldon and Carr. Since 1952, I have been either a sole practitioner, partner or officer of a firm in consulting practice. Clients served have included, among numerous others, five television broadcast networks (ABC, NBC, CBS, PBS and Fox), group owners of radio and television stations, the Association for Maximum Service Television, Inc., the National Association of Broadcasters (NAB), and the Electronic

Industries Association. My testimony as a qualified professional engineer has been accepted by Federal and State courts, the Federal Communications Commission (FCC), and various local boards. I hold professional engineer licenses issued by the District of Columbia, the location of my office, and by the Commonwealth of Virginia, the place of my residence. I am a Life Fellow in both the Institute of Electrical and Electronics Engineers and the Society of Motion Picture and Television Engineers. I am a member of the National Society of Professional Engineers and the American Association for the Advancement of Science. I was elected to membership in Tau Beta Pi, the engineering scholastic honorary. I received the 1988 Engineering Achievement Award of the NAB and the 1992 Engineering Achievement Award of the Broadcast Pioneers Washington Chapter.

2. I have been asked by counsel for the plaintiffs in the above-captioned action to supervise two efforts -- creation of maps and actual signal intensity testing -- designed to assess whether, and to what extent, PrimeTime 24 is violating the requirements of the Satellite Home Viewer Act ("SHVA" or "the Act"). My understanding is that the Act authorizes satellite carriers, such as PrimeTime 24, to deliver distant network stations (including CBS and Fox stations) to satellite dish owners, but only to "unserved households" for private home viewing.

Background

3. The definition of "unserved household" in the SHVA includes, among other things, the requirement that the household "cannot receive, through the use of a conventional outdoor rooftop receiving antenna, an over-the-air signal of Grade B intensity (as defined by the Federal Communications Commission) of a primary network station affiliated with that network." 17 U.S.C. § 119 (d) (10)(A). Long ago, the FCC defined the term Grade B field strength (intensity) in its regulations: the term is defined as the number of decibels (dB) above a field intensity of one microvolt per meter. The unit is expressed by the FCC as "dBu." (The "u", is actually the Greek letter "μ," but, for simplicity it is usually written and pronounced as a "u.")

4. Television stations use towers -- often very tall towers, or shorter towers placed at high locations such as mountaintops -- to broadcast their signals over the air to viewers. For example, the CBS station in Miami, WFOR-TV, and the Fox station in Miami, WSVN, operate from towers approximately 1,000 feet in height from an "antenna farm" in North Dade County, Florida.

5. The FCC defines three levels of intensity of over-the-air signals, "City Grade," "Grade A" and "Grade B." The FCC's definition of Grade B intensity -- which the SHVA incorporates by reference -- is a median signal strength level of 47 dBu (224 microvolts per meter) for television channels 2-6 (low VHF), 56 dBu (631 microvolts per

meter) for channels 7-13 (high VHF), and 64 dBu (1,585 microvolts per meter) for channels 14-69 (UHF). 47 C.F.R. § 73.683(a).

6. The decibel is a unit of measurement originally applied to the intensity of sound. Unlike a more familiar ("linear") measuring scale such as temperature in degrees Fahrenheit, dBu's are a highly compressed, "logarithmic" scale. For example, an increase in field intensity from 60 to 80 dBu is a tenfold increase in intensity. A dBu reading of 100 reflects an intensity 100 times stronger than a dBu reading of 60.

Maps of Predicted Signal Intensity

7. The traditional method of predicting a station's signal intensity is to use maps showing contours representing the outer boundaries of grades of service. The prediction method, as specified by the FCC, places particular emphasis on the terrain between two and ten miles from the transmitter, and assumes the national average terrain roughness beyond that distance. Each station is required to file a map, or maps, with the FCC showing its predicted service grades. In the case of some stations, such as WFOR-TV in Miami, these contours appear as concentric circles.

8. In reality, of course, the terrain surrounding any given station's transmitter is unlikely to be at the national "average." For that reason, engineers and scientists have developed signal propagation models that take into account the actual terrain surrounding any given television transmitter. The most widely-used propagation model is referred to as the "Longley-Rice" model. The Longley-Rice model, now in the form of a computer

program, had its origins in Technical Note 101, a publication of the National Bureau of Standards (now the National Institute of Standards and Technology). Technical Note 101 was issued in 1965 and is entitled "Transmission Loss Predictions for Tropospheric Communications Circuits." Its authors were: P.L. Rice, A.G. Longley, K.A. Norton, and A.P. Borsis. The model has been refined over the years by U.S. Government scientists to take into account the availability of improved terrain data bases and the increased sophistication of desktop computers. The model analyzes the terrain point-by-point along radial paths from the transmitter (usually at one-degree azimuth intervals), determines the nature of the obstructions, and provides a map output with indications of where particular field intensities are exceeded. Alternatively, the area of interest is divided into a large number of cells and, based on the terrain from the transmitter to each cell, the program determines whether the specified field intensity or greater is found in that cell. The field intensity loss in strength at increasing distances from the transmitter is a function of whether the path is unobstructed, is generally irregular, is marked by a single prominent obstruction that may be either "knife edged" or rounded, or by multiple prominent obstructions substantially higher than the intervening terrain. Calculations take into effect the particular frequency transmitted since the effect of a particular obstruction is frequency dependent. The model also takes into account atmospheric refractivity near the surface of the earth.

9. The Institute for Telecommunications Sciences (ITS), located in Boulder, Colorado, is the chief research and engineering arm of the National Telecommunications and Information Administration (NTIA), U.S. Department of Commerce. Upon request, ITS has

been providing field intensity maps, based on the Longley-Rice propagation model, for specific areas and television stations since early in the 1980s.

Creation of Maps Showing Station Signal Levels and Locations of PrimeTime 24 Subscribers

10. To illustrate PrimeTime 24's service patterns on a national basis, maps have been generated for forty-three stations around the country. A tabulation of the stations mapped is included in Exhibit A. Copies of the maps are included as Exhibit B. The maps generated are for (1) CBS or Fox stations in each of the top 15 Defined Market Areas (DMAs), (2) Fifteen randomly selected stations in DMAs 17-100 (note -- Miami is DMA 16), (3) Five randomly selected stations in DMAs 101-211, (4) Three additional CBS or Fox affiliates in southern Florida, and (5) Five stations that are named plaintiffs in this case. Where applicable, service provided by translators, which extend a station's coverage, is included together with the service provided by the "mother" station.

11. For each station mapped, the maps show three things: (a) the station's traditional FCC contours (both A and B); (b) the results of a Longley-Rice analysis of the station's predicted signal intensity; and (c) the locations of new PrimeTime 24 subscribers since January 1, 1996 (those signed up through DirectTV).[1/] Subscriber locations by

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[1/] For the majority of maps shown, the map projection used is one that assumes equal distances for one degree of either latitude or longitude. Since at high or low latitudes that projection appears to make a circular plot elliptical, an Albers Equal Area Projection was used for stations in Florida and North Dakota. The use of a particular projection does not affect the relationship of the locations of subscribers to the level of service because identical projection assumptions were made for plotting both.

geographic coordinates were first obtained for as many subscribers as possible. To insure maximum accuracy, this "geocoding" process was done only for subscribers whose addresses could be identified with a high level of precision. (For example, pinpointing the location of a subscriber is not possible when provided only a Post Office box as an address.) Then, with the aid of a computer program, those coordinates were employed to plot the subscriber locations on the maps. Comparison of the plotted subscriber locations, together with the depiction of those areas with signal intensity in excess of Grade B, provides a ready source for predicting the locations of households ineligible for delivery of network stations by direct broadcasting from satellite.

12. The maps are designed to show the locations of PrimeTime 24 subscribers who are either (a) within the predicted FCC Grade A or Grade B contours of the station being mapped, or (b) within the predicted Longley-Rice Grade A or Grade B signal intensity area for the station.

13. Review of the maps shows that large numbers of new PrimeTime 24 subscribers are located in areas where the relevant CBS or Fox station has predicted field intensity, using a Longley-Rice analysis, in excess of Grade B. Indeed, as these maps show, PrimeTime 24 has large numbers of customers within the predicted Grade A contours of every station mapped.[2]

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[2] These maps show only one station at a time. As a result, in a few instances there appear to be clusters of subscribers at the outer edge of a station's coverage area. In fact, these are subscribers in nearby cities -- whose television stations' coverage areas are not shown on the map. For example, in the map of the Toledo CBS station, WTOL, there is a

Testing of Randomly Selected Subscribers in Dade and Broward Counties

14. To determine actual field intensities at PrimeTime 24 subscriber household locations in Dade and Broward Counties, I arranged for counsel to retain the consulting engineering firm of Moffett, Larson & Johnson (MLJ) to make measurements following a prescribed procedure. MLJ is a firm respected by professional engineers and the broadcasting community for its long history of competent engineering performance. I have known for perhaps two decades or more the engineer who actually conducted the measurements under my direction.

15. Measurements were made at 100 locations randomly selected from new May, 1996, PrimeTime 24 subscribers in Dade and Broward Counties who received a distant CBS station. From a listing of 800 subscribers, every eighth entry was selected for the 100-location sample. At each of the 100 locations, measurements were made of the signal intensity of WFOR-TV, the CBS-owned station operating on Channel 4, and WSVN(TV), the Fox network affiliated station operating on Channel 7. In both cases, the community of license is Miami.

16. The measurement procedure followed was based on that prescribed by the FCC in 47 C.F.R. § 73.686. At the accessible road closest to the household, a mobile run

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concentration of subscribers to the north of Toledo; these subscribers live in the Detroit area, which, of course, has its own local station. Similar clusters appear on the maps for Milwaukee (reflecting subscribers in the Chicago area); for Winston-Salem, North Carolina (reflecting subscribers in the Raleigh-Durham and Charlotte areas); for Cedar Rapids, Iowa (reflecting subscribers in the Dubuque area); for Colorado Springs (reflecting subscribers in the Denver area); and for Columbus, Georgia (reflecting subscribers in the Atlanta area).

for a distance of 100 feet was made with a conventional rooftop antenna elevated to 30 feet, while recording the station's field intensity and storing the data in a computer. Analysis of the data, made with the aid of a computer program, permitted the extraction of the maximum, minimum, and median field intensity found, together with the standard deviation.[3]

17. Results of the measurement program are provided in accompanying tabulations (Exhibits C and D). Maximum, minimum and median field intensities are provided for each location. Also shown are the standard deviations and the median field intensity minus the standard deviation. Median field intensity minus standard deviation is a measure of the least signal intensity likely to be found at the specific location of the household. At each of the 100 locations, measurements were made of the field intensity of both WFOR-TV and WSVN. All 200 measurements showed median field intensity minus one standard deviation to be greater than Grade B. The excess of the median minus one standard deviation over Grade B ranged from a minimum of 2.3 times to a maximum of 1,580 times. On average, these households received a signal 74 times stronger than the Grade B minimum for WFOR-TV, and 69 times stronger than the Grade B minimum for WSVN. Of the 100 locations tested, 95 received a signal of at least Grade A intensity from WFOR-TV, and 99 received a signal of at least Grade A intensity from WSVN.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

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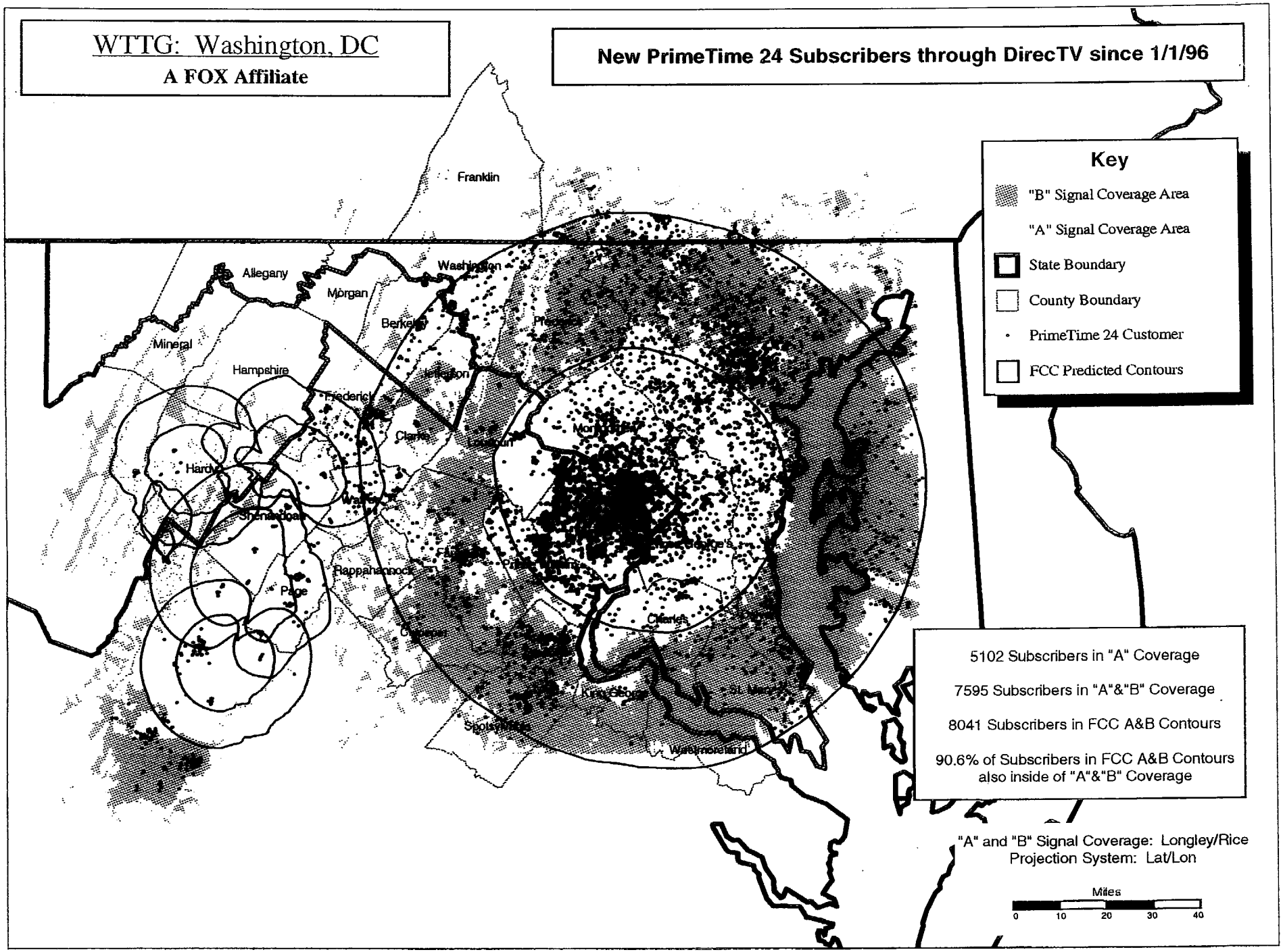
[3] Standard deviation is a statistical concept providing a measure of the variability of the data. In mathematical terms, it is the square root of the arithmetic average of the squares of the deviation from the mean (average) of the data collected.

Executed on March 8, 1997.

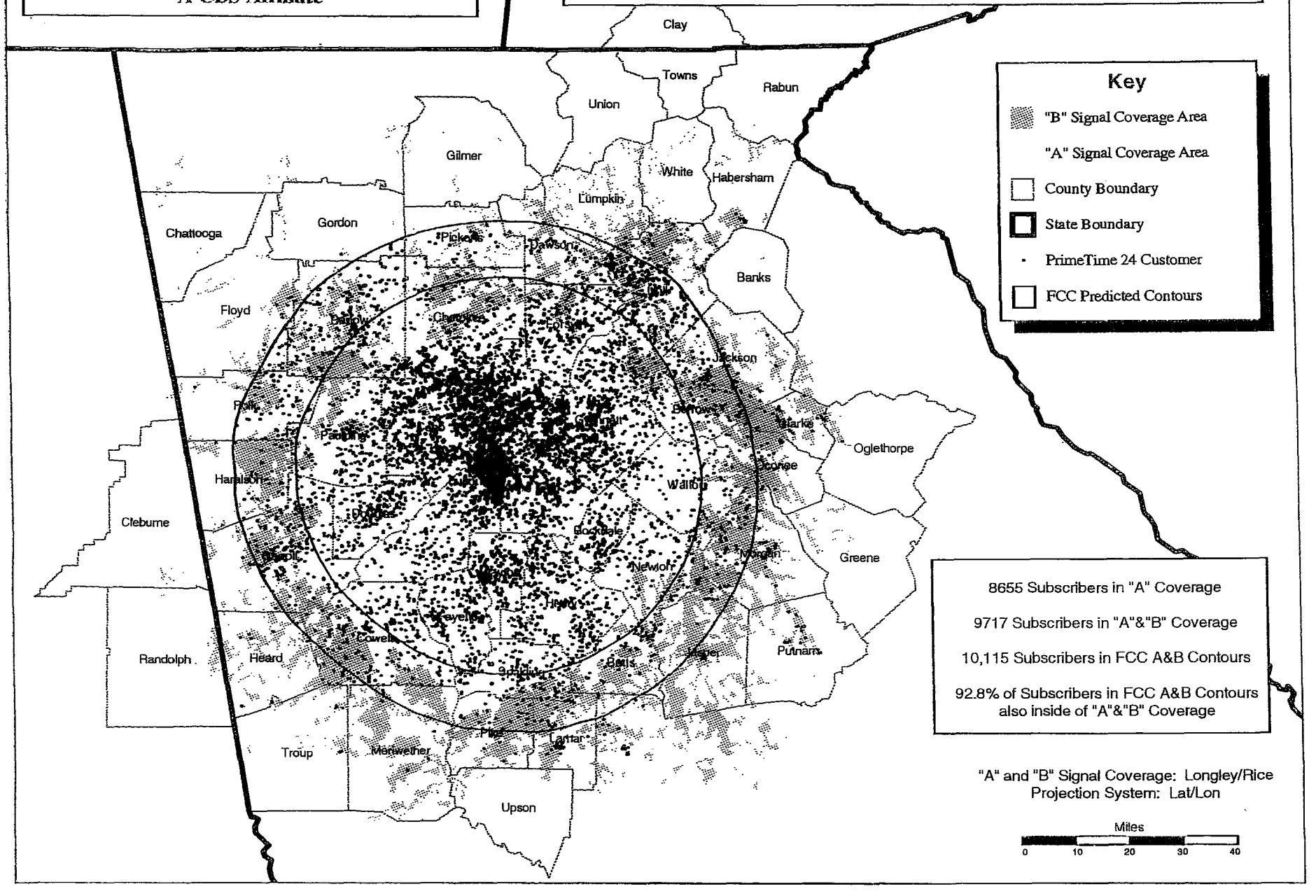
Jules Cohen, P.E.


WTTG: Washington, DC
A FOX Affiliate
New PrimeTime 24 Subscribers through DirecTV since 1/1/96
Key
"B" Signal Coverage Area
"A" Signal Coverage Area
State Boundary
County Boundary
PrimeTime 24 Customer
FCC Predicted Contours
Franklin
Allegany
Morgan
Washington
Berkeley
Mineral
Hampshire
Jefferson
Frederick
Clarke
Loudoun
Hardy
Shenandoah
Warren
Rappahannock
Page
Culpeper
Clarke
King George
Westmoreland
5102 Subscribers in "A" Coverage
7595 Subscribers in "A"&"B" Coverage
8041 Subscribers in FCC A&B Contours
90.6% of Subscribers in FCC A&B Contours also inside of "A"&"B" Coverage
"A" and "B" Signal Coverage: Longley/Rice
Projection System: Lat/Lon
Miles
0
10
20
30
40

WGNX: Atlanta, GA

A CBS Affiliate

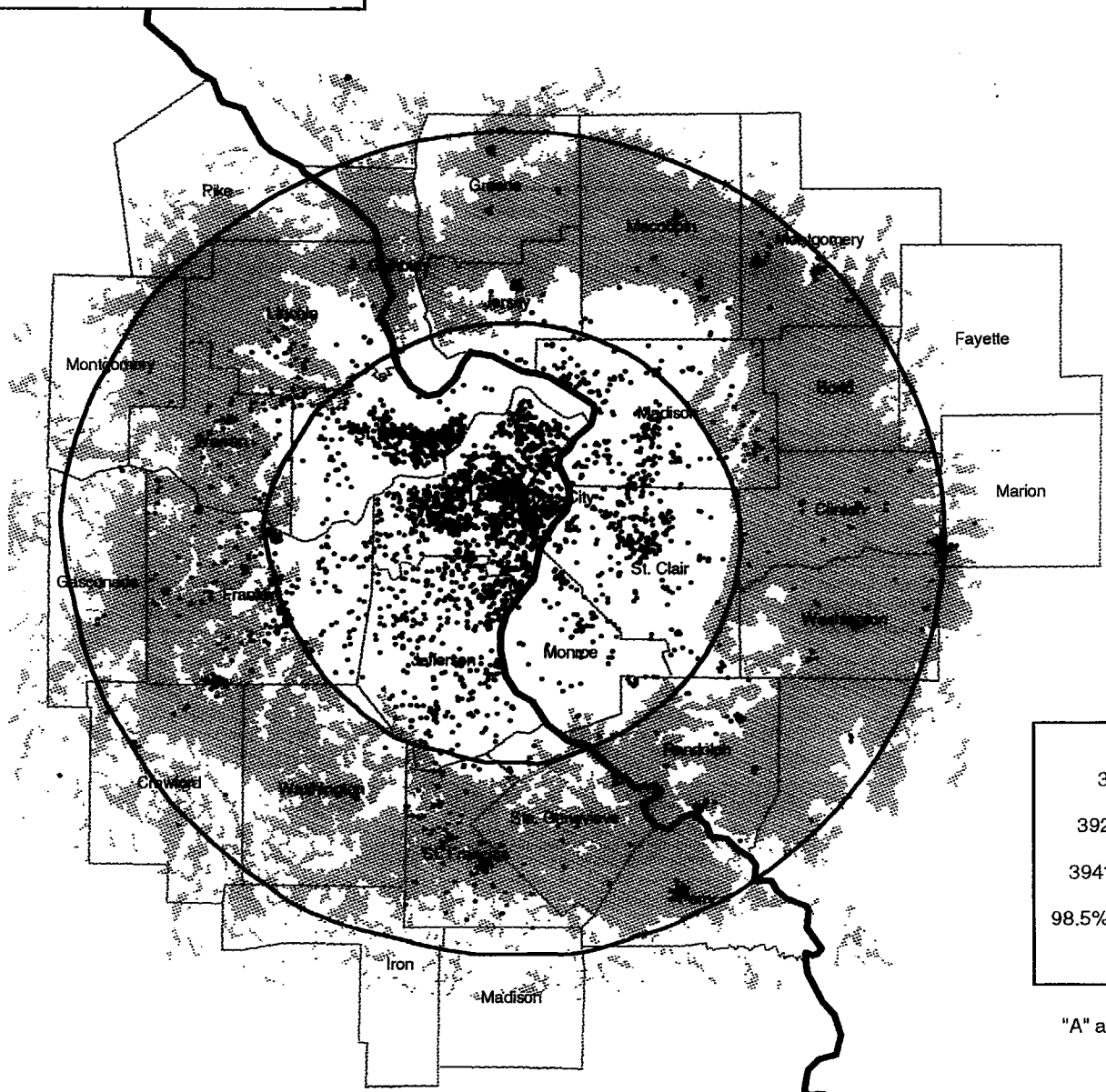
New PrimeTime 24 Subscribers through DirecTV since 1/1/96



KTVI: St. Louis, MO

A FOX Affiliate

New PrimeTime 24 Subscribers through DirecTV since 1/1/96



Key

- "B" Signal Coverage Area
- "A" Signal Coverage Area
- County Boundary
- State Boundary
- PrimeTime 24 Customer
- FCC Predicted Contours

3125 Subscribers in "A" Coverage

3923 Subscribers in "A"&"B" Coverage

3941 Subscribers in FCC A&B Contours

98.5% of Subscribers in FCC A&B Contours also inside of "A"&"B" Coverage

"A" and "B" Signal Coverage: Longley/Rice
Projection System: Lat/Lon

Miles

0 10 20 30 40

EXHIBIT 4
Declaration of Richard L. Boyce

Declaration of Richard L. Boyce

1. I am President of Econometrica International, Inc. In my work, I employ statistical analysis on a regular basis. I earned an A.B. in mathematics from Occidental College in 1968 and a Ph.D. in economics from the University of California at Santa Barbara in 1975. From 1977 to 1983, I was an assistant professor of economics at the State University of New York at Binghamton, where I taught graduate and undergraduate courses in mathematical statistics and econometrics. Both from my educational and teaching background and from my professional work, I am well-acquainted with the standard techniques of statistical analysis.

2. I applied standard statistical techniques to the data set titled "Terrestrial ATV Test Data Summary (Chan 53)," to test whether or not there is a linear relationship between the dependent variable "Impairment, GC-Off" (which I understand to be a subjective assessment of picture quality) and the independent variable "Field Strength,(dBuV/m)" (which I understand to be a point measurement of field strength). I understand that the variable "Field Strength, (dBuV/m)" was measured at the same time and place at which the television picture was evaluated.

3. I calculated the simple correlation between these two variables as .74. In my opinion, correlations of this magnitude indicate a strong likelihood of a linear relationship between the two variables, i.e., that a stronger signal is likely to be associated with a better picture.

4. I also calculated the coefficients of a linear equation relating "Impairment. GC_Off" and the point measure of field strength and a constant term using least squares regression. The R-squared term for a least squares linear regression measures the percentage of the squared deviations of the dependent variable around its mean value that is explained by the deviations of the independent variable about its mean. In other words, the R-squared statistic measures the degree to which differences in picture quality assessments can be explained by differences in field strength. The calculated R-squared value here is .55. In my opinion, an R-squared value of this magnitude indicates a strong likelihood of a linear relationship between the two variables.

5. The slope coefficient of a linear equation measures the change in the dependent variable (here, a subjective assessment of picture quality) associated with a unit change in the independent variable (here, signal strength) for the data set from which the slope coefficient was calculated. The magnitude of the slope coefficient, when combined with the measures of variability of the slope coefficient, permit a statistical test of the question whether or not there is a linear relationship between the dependent and the independent variables. That is, using the "Parameter Estimate" and the "Standard Error" of the slope coefficient, a "t-statistic" can be calculated and used to test the formal hypothesis that the true slope is zero. If the true slope is zero, there is no linear relationship between the dependent and independent variables. The calculated slope for the Channel 53 data is .056 and the calculated t-statistic is 15.39. In my opinion, a positive slope and a t-statistic value of this magnitude indicates a very strong likelihood of a positive linear relationship between the two variables.

6. Taken together, the magnitude of the correlation, the size of the R-squared value, and the positive slope and large t-statistic value, indicate, in my opinion, that there is virtually no likelihood that signal strength and subjective assessments of picture quality are unrelated.

7. I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

Executed on June 17, 1997.

Richard L. Boyce