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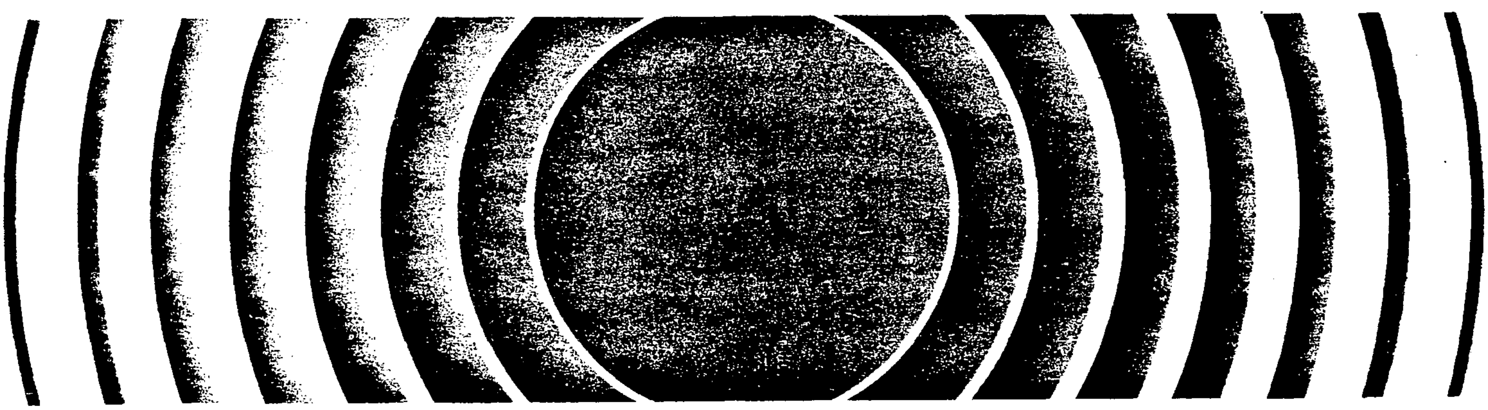
Radiofrequency Radiation Levels And Population Exposure In Urban Areas Of The Eastern United States



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As part of a program to determine the need for environmental radiofrequency exposure standards, the U.S. Environmental Protection Agency began measuring levels of nonionizing electromagnetic radiation in urban areas of the United States in October 1975. By October 1976 surveys in seven selected cities of the Eastern United States had been completed, namely, Atlanta, Boston, Chicago, Miami, New York, Philadelphia, and Washington, DC. This report describes the measurement system, presents a summary of the environmental measurements, and gives one method of predicting population exposure from the environmental measurements.

Environmental data were collected with a van mounted system consisting of antennas, a spectrum analyzer, and a minicomputer. Measurements were made in seven frequency bands between 0.01 and 900 MHz in which pilot studies had indicated that the most significant environmental exposures occur. Environmental data were collected at 193 sites in the seven cities. Values of power density integrated over the frequency range from 55 to 900 MHz generally fall into the range between 0.001 and 1.0 microwatt per square centimeter ($\mu W/cm^2$) with a median site value of about 0.01 $\mu W/cm^2$. A model was developed which can be used to extrapolate the measured data to other points within the seven cities. Estimates of population exposure were obtained by combining this model with an automated population data base.

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RADIOFREQUENCY RADIATION LEVELS AND POPULATION EXPOSURE IN URBAN AREAS OF THE EASTERN UNITED STATES

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DISCLAIMER

PREFACE

The Office of Radiation Programs of the Environmental Protection Agency carries out a national program designed to evaluate population exposure to ionizing and nonionizing radiation, and to promote development of controls necessary to protect the public health and safety. This report summarizes the results of environmental measurements of nonionizing, electromagnetic radiation that were made in seven major metropolitan areas of the eastern United States. Readers of this report are encouraged to inform the Office of Radiation Programs of any omissions or errors.

W. D. Rowe, Ph.D.
Deputy Assistant Administrator
for Radiation Programs

RADIOFREQUENCY RADIATION LEVELS AND POPULATION EXPOSURE IN URBAN AREAS OF THE EASTERN UNITED STATES

ABSTRACT

As part of a program to determine the need for environmental radiofrequency exposure standards, the U.S. Environmental Protection Agency began measuring levels of nonionizing electromagnetic radiation in urban areas of the United States in October 1975. By October 1976 surveys in seven selected cities of the Eastern United States had been completed, namely, Atlanta, Boston, Chicago, Miami, New York, Philadelphia, and Washington, DC. This report describes the measurement system, presents a summary of the environmental measurements, and gives one method of predicting population exposure from the environmental measurements.

Environmental data were collected with a van mounted system consisting of antennas, a spectrum analyzer, and a minicomputer. Measurements were made in seven frequency bands between 0.01 and 900 MHz in which pilot studies had indicated that the most significant environmental exposures occur. Environmental data were collected at 193 sites in the seven cities. Values of power density integrated over the frequency range from 55 to 900 MHz generally fall into the range between 0.001 and 1.0 microwatt per square centimeter ($\mu W/cm^2$) with a median site value of about 0.01 $\mu W/cm^2$. A model was developed which can be used to extrapolate the measured data to other points within the seven cities. Estimates of population exposure were obtained by combining this model with an automated population data base.

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I. INTRODUCTION

As a part of a program to determine the need for environmental radiofrequency exposure guidance, the U.S. Environmental Protection Agency began measuring levels of radiofrequency electromagnetic radiation in urban areas of the United States in October 1975. By October 1976 surveys in seven selected cities of the Eastern United States had been completed, namely, Atlanta, Boston, Chicago, Miami, New York, Philadelphia, and Washington, DC. This paper describes the measurement system, presents a summary of the environmental measurements, and gives one method of predicting population exposure from the measured data. The measurement system (1), and summaries of the site (2) and population exposure (3) for Atlanta, Boston, Miami, and Philadelphia have been previously described.

Environmental data were collected with a van-mounted system consisting of antennas, a spectrum analyzer, and a minicomputer. Measurements were made in the seven frequency bands between 0.01 and 900 MHz where pilot studies had indicated that the most significant environmental exposures occur (4). Environmental data were collected at 193 sites in the seven cities. Values of power density integrated over the frequency range from 46 to 900 MHz generally fall into the range between 0.001 and 1.0 microwatts per square centimeter ($\mu W/cm^2$) with a median site value of about .02-.03 $\mu W/cm^2$. A model was developed which can be used to extrapolate the measured data to other points within the seven cities. By combining this model with an automated population data base, estimates of population exposure were obtained for the seven cities and will be presented.

II. EQUIPMENT

A block diagram of the measurement system is shown in figure 1. Basically, the system is composed of a scanning spectrum analyzer with several different types of antenna systems, depending on the particular band of interest, interfaced to a minicomputer data acquisition system. This instrumentation concept was proposed for spectrum engineering applications by the Joint Technical Advisory Committee (5) and studied by Hagn, et al. (6) for spectrum occupancy, compliance, and electromagnetic compatibility applications. Several systems of this type are being used for spectrum management (7, 8, 9). Signals from the antenna are processed by the spectrum analyzer and analog amplitude information is digitized and input to the minicomputer where it is subsequently processed with data correction and analysis routines. The spectrum analyzer is controlled by the computer through trigger signals, while other signals under program control provide for other events such as antenna switching.

Detection Hardware

The principal detection equipment consists of a Hewlett Packard spectrum analyzer mainframe with variable persistence display and a number of plug-in radio-frequency sections to provide a total detection range from 20 Hz to 18 GHz. Normally the narrow band signal peak height is taken as the received signal's power.

The data acquisition system is configured around a Varian Data Machines central processing unit (CPU) with a 750 nsec cycle time and 32000 16-bit words of core memory. A 123000 word, fixed-head, disk provides high speed mass storage for the system operating software, programs, and data. Additional mass storage is provided by a dual-head, flexible disk unit. A large screen CRT is used to display alphanumeric and graphic data while a standard ASR-33 teletype is the main input device for the operator. To facilitate interfacing to other instruments, a console is provided for access to various hardware features of the system which include a 13-bit resolution analog-to-digital converter (ADC) multiplexed to 16 channels, two digital-to-analog converters (one with 14-bit and the other with 10-bit resolution) for outputing voltages, single-bit inputs for sensing the status of various events, and program-controlled switches.

Connection to the spectrum analyzer is accomplished via the interface console. A trigger signal is developed by one of the digital-to-analog converters, and the analog amplitude signal from the analyzer is read in through one of the ADC's multiplexed channels.

Figure 2 is a photograph of the system as it appears in the measurement van. The radiofrequency detection equipment is in the rack to the left and the data acquisition system is beyond the operator. A hardcopy unit provides finished paper copies of the CRT display.

Antennas

Table 1 lists the different antennas used with the system in the different monitoring bands. Most of the antenna systems were designed to be omnidirectional so that the amplitude of all signals in a band can be obtained, regardless of direction to the source. The antennas were also designed to be responsive to the significant polarization components in the various bands.

System Calibrations

Each antenna employed for routine monitoring was calibrated across its intended frequency by referencing it, indirectly to a set of National Bureau of Standards (NBS) calibrated, standard dipoles. This was accomplished by first using the NBS antennas to calibrate a set of Singer tuneable dipoles which cover the frequency range of 30 to 1,000 MHz, and then using the Singer dipoles at appropriate frequencies to calibrate, by the comparison technique, the system monitoring antennas.

These calibrations were carried out with the antennas in their normally used position on the van. The calibrating field was established with a dipole antenna at a distance of 600 feet. Antenna calibration data were recorded at appropriate frequency intervals for each system for maximum signal strength, i.e., main lobe alignment. In the case of orthogonally constructed dipoles, measurements were individually performed for each dipole in the array.

For the horizontal, orthogonal dipoles, it is necessary to obtain the radiation pattern for each dipole. These patterns were obtained with the antennas mounted on the van at the antenna range and turntable of the Institute for Telecommunications Science (U.S. Dept. of Commerce) near Boulder, Colorado. The patterns from the two dipoles may then be added to obtain the overall pattern for horizontally polarized signals. This composite pattern is not completely uniform for all directions, but the average over all angles is within 2.2 dB of the extremes. The maxima of the composite pattern are obtained at the points where the individual dipoles have their maxima, these latter points being referenced (indirectly) to the standard dipoles. The difference between the composite maxima and the angular average response is incorporated into the overall antenna factor.

Table 2 provides a summary of the total uncertainties measured for the overall system. The total system uncertainty consists of these components: the basic calibration accuracy of the NBS standard dipoles, the uncertainty due to using the Singer dipoles at frequencies between calibration points, the uncertainty associated with the fitting of a functional form to the measured calibration curves for the monitoring antennas, an uncertainty due to the angular dependence of the antenna system being used, and a system conversion uncertainty which is a measure of the spectrum analyzer-computer system's ability to accurately detect, plot, and record radiofrequency signal levels. Each of these factors are provided in Table 2 and show that the system has a total uncertainty no greater than 2.5 dB. The angular dependence error also includes a factor for a slight variation of the angular dependence upon frequency.

The whole measurement system described here is installed in a 27-foot Travco van for portable operation. A pneumatic, telescoping mast attached to the rear of the van is used for elevating the antennas to their standard measurement heights. Two separate 6 KW electric generators are used for power, one unit dedicated to instrumentation, and the other to utilities.

III. MEASUREMENTS

Environmental surveys were carried out in seven cities in the Eastern United States during 1975-6. These cities are listed in Table 3 with the dates of the survey and the number of measurement sites. The measurement sites were selected primarily on the basis of population distribution, i.e., sites which cover the most heavily populated areas. Additional criteria were the geographic area to be covered and the distribution of source of radiofrequency radiation.

The seven discrete bands defined in Table 2 were monitored at most of the sites. Previous results had indicated that these bands cover all of the most environmentally significant sources (4). After the first few metropolitan surveys, the two land mobile bands were found to be relatively insignificant as environmental radiofrequency radiation sources. Therefore, these two bands were only monitored at about one-third of the sites during the last few surveys.

At each measurement site a number of scans, 25-50, are taken in each band with the antennas at approximately 6.2 meters above ground, and the rms average of the electric field strength spectra is computed. In the land mobile bands, the signals are intermittent, and in these cases the maximum values obtained at each frequency are also saved and displayed as "peak" spectra. After the data for a band have been collected, the total power density in the band is calculated. When measurements at a site have been completed, the location is marked on a U.S.G.S. (7.5 minute) map, and the geographic coordinates are determined to within one second (about 30 meters).

Examples of system output for several bands are shown in figures 3-6. These represent actual environmental data collected during the first few field trips. Figure 3 shows the FM band for a site in Atlanta. All system calibration factors are included so that the absolute field strength of any signal is obtained. The dynamic range capabilities of the system are illustrated in this figure, the highest levels being a factor of 10^6 greater than the lowest. The total dynamic range is about eight orders of magnitude (80 dB).

Figure 4 is an example of data collected in the lower half of the VHF-TV bands (channels 2-6). Only channels 3 (60-66 MHz) and 6 (82-88 MHz) are on-the-air at this site in Philadelphia. Part of the FM band is shown from 88-96 MHz, but these signals are not included in the power density total for this band. Figure 5 shows the upper half of the VHF-TV band at another location. An example of the VHF land mobile band is shown in Figure 6.

Data were collected at 193 sites in the seven metropolitan area surveys. Table 4 shows for each site, the power density in each of the seven bands and the total power density summed over the upper six frequency bands. The 0-2 MHz band is not included in the total because it is not covered by the ANSI and OSHA standards and is not directly comparable to the results from the higher frequency bands. There are significant differences in total power density between the various sites within each city. The values typically range over five orders of magnitude, from about .0001 to 10 $\mu W/cm^2$.

The fraction of sites at which the total power density exceeds any given value is shown in figure 7. Since the sites were not chosen solely on the basis of population density, the population exposure curve will not coincide with this one. However, it does permit a comparison of the relative significance of the different bands. The distribution of power densities for several of the bands is also shown in figure 7. The land mobile bands are seen to contribute the least exposure of the bands considered. The UHF television transmitters, in spite of having the highest effective isotropic radiated power, are not as significant as a class as the FM radio and VHF television bands.

IV. POPULATION EXPOSURE

By population exposure to nonionizing radiation is meant the number of people exposed at various levels of power density. Two kinds of information are required to obtain the population exposure: the distribution of the population and the distribution of power densities in the area of interest. There are inherent limitations on accuracy and completeness with which these two distributions can be determined as will be discussed, but valuable information may still be obtained on population exposure in spite of the limitations.

There is only one automated population data base available at present and this is the U.S. Census Bureau's "Master Enumeration List with Coordinates" (1970) which consists of data from 250,000 Census Enumeration Districts (CEDs). Each data record contains the state code, county code, housing count, population count, and geographic coordinates of the approximate centroid of population for the CED. When using this data base one assumes, for exposure calculations, that all the population of a district is concentrated at the centroid. There is no information on actual occupancy or daily movement of the population in this data base.

If the population data base described above is used, then the best estimate of population exposure would result if measurements were made at each CED centroid in an area of interest. Since there may be several thousand districts in an urban area, this is clearly not feasible. With the present measurement system, whose measurement rate is limited by the changing of the antennas, a maximum of about 40 sites can be surveyed during a two week field study. Therefore, another approach is required.

The approach we have developed which seems to get the most from our measurement capability is basically an extrapolation of the measurements we made to other nearby points of interest. First, it was observed that the measured data from each source tended to generally fall along a parabola when plotted as Log (power density) versus Log (distance) as shown in Figure 8. Furthermore, the shape of the parabola was approximately the same for all sources, regardless of source parameters, differing from source to source only by an additive constant. A suitable parabola for fitting the data from all the individual sources was found to be

$$E\ (\mathrm{dBuV/m}) = -\ 20\ (\mathrm{Log}\ D)^2 - 10\ \mathrm{Log}\ D + A$$

where D is the distance in miles and A is the additive constant. When the points from each individual source of Figure 8 are fit group by group to this equation, and every group of points is plotted on the same graph, there is a good fit as shown in Figure 9 for the Miami data.

To determine the field strength at any point such as a CED centroid, in an area where measurements have been made, the three measurement sites nearest the point of interest are determined. From the data measured at these three points, a parabola is fitted to the points. Substitution of the distance from the source to the point of interest into the expression for E yields the required field strength estimate for the source at that point (See Figure 10). The individual source contributions can be appropriately summed to get the total power density at that point. When this approach is applied to each CED centroid in an area of interest, the population of each CED can be assigned the exposure of its centroid, and the population exposed at the various levels can be accumulated. There will be a fairly large variance for any individual field strength calculation, but when the model is applied to large numbers of CEDs, the resulting population exposure estimates should be valid.

This method for estimating population exposure was applied to each CED in the seven metropolitan areas where measurements have been completed. The total population in these areas is about 28 million. Figure 11 shows the fraction of the total population that is exposed to the power density values indicated on the horizontal axis. "Zero" on the horizontal scale corresponds to 1 microwatt per square centimeter, and -3 corresponds to 1 nanowatt per square centimeter. The median power density value is about .01 microwatt per square centimeter, with about 1% of the population exposed at levels above 1 microwatt per square centimeter.

The population exposure curves for each of the seven cities are shown in Figure 12-18. The median exposure values range from about .002 $\mu W/cm^2$ for New York up to about .02 $\mu W/cm^2$ for Boston. For all of the cities, the exposure of 98 to 99 percent of the population is less than 1 $\mu W/cm^2$.

The fraction of the population in each city which is exposed at any level is somewhat dependent on the definition of the city boundaries. The selection of the boundaries was somewhat arbitrary in this study, i. e., they do not conform to any standard metropolitan area definitions. In each case a rectangular area bounded by a pair of latitudes and longitudes was chosen. Table 5 shows the definitions of the area included in the population exposure calculation for each city.

The population data base only has information on where people reside and cannot reflect the daily movement of the population. The field strength model, being based on unobstructed measurements 6 meters above ground, cannot give precise information on the exposures people receive inside dwellings. Therefore, "population exposure," as used in this report, means "the number of people residing in urban areas where an unobstructed measurement 6 meters above ground would fall in the indicated power density range."

We cannot extrapolate the population exposure results to fewer numbers of people because of the basic limitations of resolution in the population data base and the field strength measurements. However, these results do describe the electromagnetic environment for the great majority of the people residing in urban areas of the Eastern United States. Any further refinement will require investigation of particular situations and individual counting of people. It should be reemphasized that our measurements were taken in a selected number of bands, but these are the bands that we believe to be the most important. Other sources may be of importance for small numbers of people, but these also will have to be studied on an individual basis.

V. SIGNIFICANCE OF LEVELS

Radiofrequency radiation protection standards have exposure limits which differ widely between countries. These limits are summarized in Table 6 for the following four countries: the U.S.S.R., Czechoslovakia, Poland, and the United States (10, 11, 12, 13, 14, 15, 16).

The existing occupational standards of the world can be generally classified into three groups on the basis of their exposure limits. In the most conservative group are the standards of the U.S.S.R. and Czechoslovakia with limits generally in the range of tens of microwatts per square centimeter. In the second group are the standards of Poland, Sweden, the Bell Telephone Labs (U.S.), and the N.V. Phillips Co. of the Netherlands with limits in the range of hundreds of microwatts per square centimeter up to about one milliwatt per square centimeter. In the third group with limits of tens of milliwatts per square centimeter are the standards of the U.S. and most of Western Europe. Canada, under a proposed standard (17), would have limits belonging to the middle group.

In the United States the principal standard is that of the American National Standards Institute (ANSI) which was reaffirmed with minor changes in 1974 (13). The Department of Defense has had similar standards since about 1953 (14), but a higher limit was adopted in 1975 for the frequency range below 10 MHz where the previous standards, including ANSI, did not apply (15). Another recommendation is that of the American Conference of Governmental Industrial Hygienists (ACGIH) (16). In 1971 the Occupational Safety and Health Administration (OSHA) adopted the ANSI standard as a national consensus standard (18) and it is now the legal standard for occupational exposure in the U.S. above 10 MHz.

Standards for exposure of the general public are generally about a factor of ten (in power) more restrictive than the occupational standards. At the present there is no general public health or environmental standard in the United States, although the ANSI occupational standard is usually followed. The microwave oven standard (19) is not a personnel standard like those already discussed, but is rather a limit on the leakage from a device. The limit for new ovens is 1 mW/cm^2, measured five centimeters from any point on the oven. Ovens in service are allowed to degrade in leakage performance to levels no greater than 5 mW/cm^2. At one meter from the oven, a level of 1 mW/cm^2 (at five centimeters) would be reduced to 2.5 $\mu W/cm^2$. Although not directly comparable to the personnel standards, the microwave oven standard should probably be considered with the most conservative group of standards.

Compared with any of these standards, the median levels of exposure measured in the urban environmental surveys are quite low. The residential levels for 98-99 percent of the population would appear to meet even the very restrictive Soviet standard. The highest levels measured with the van system in the seven cities was about 10 $\mu W/cm^2$.

For the one percent of the population which is potentially exposed at the highest levels, such as people who reside or work in tall buildings near high-power broadcast transmitters, exposures may range up into the tens of microwatts per square centimeter or higher (20). These higher exposure situations must be studied on an individual basis to obtain the actual levels and the numbers of people who are affected.

VI. SUMMARY

A system for making environmental measurements of nonionizing radiation with a precision of 2.5 dB has been developed. The system consists of several antenna systems with a spectrum analyzer interfaced to a minicomputer data acquisition system. The system is installed in a 27-foot van for portable operation.

Environmental surveys have been completed in seven eastern metropolitan areas and the results from measurements at 193 sites were presented. The power density values range over five orders of magnitude, from .0001 to 10 $\mu W/cm^2$, with a median value of about .02 $\mu W/cm^2$. The data show that FM radio and VHF television transmitters are the most significant environmental sources of nonionizing radiation.

A model for population exposure was discussed and it was applied to the seven areas where measurements have been made. The results show that about 98-99% of the people reside in areas where the levels are less than 1.0 μW/cm^2. The median exposure level is about .01 μW/cm^2.

These levels are quite low compared to the ANSI and OSHA occupational exposure guides of 10000 μW/cm^2. Apparently, even the very restrictive environmental guideline of 1 μW/cm^2 proposed in the Soviet Union would be exceeded only for one or two percent of the population in these seven metropolitan areas. The actual levels at which these one or two percent of the people are exposed will have to be determined by examining exposure conditions on a case-by-case basis.

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TABLE 1

Antennas Used For Environmental
Radio-Frequency Measurements

FREQUENCY (MHz)	USE	ANTENNA
0-2	VLF Communications and AM Standard Broadcast	Active Vertical Monopole
54-88	Low VHF Television Broadcast	Two Horizontal Orthogonal Dipoles
88-108	FM Broadcast	Three Orthogonal Dipoles
150-162	VHF Land Mobile	Vertical Coaxial Dipole
174-216	High VHF Television Broadcast	Two Horizontal Orthogonal Dipoles
450-470	UHF Land Mobile	Vertical Coaxial Dipole
470-806	UHF Television Broadcast	Horizontal Polarized Directional Log Periodic

TABLE 2

Summary of Overall System Errors (dB)

Band	NBS Dipole	Singer Dipole	Curve Fit	Angular Dependence	System Conversion	Resulting RMS Error
AM	1.5 dB*	N/A	0.4	0.5	0.5	1.6
Low VHF	1.0	0.6	0.8	2.2	0.5	2.5
FM	1.0	0.6	0.4	1.8	0.5	2.1
Low LM	1.0	0.7	0.7	0.8	0.5	1.6
High VHF	1.0	0.8	0.5	2.0	0.5	2.3
High LM	1.0	0.5	1.5	1.1	0.5	2.0
UHF	1.0	1.1	1.2	1.0	0.5	2.0

* Referenced directly to NBS field strength meter (Rhodes and Swartz type HFH). The system as now configured is limited to detecting changes in RF level no smaller than 0.25 dB which is a limitation imposed by the resolution of the ADC.

TABLE 3

Environmental Surveys

City	Survey Period	Sites Surveyed
Boston	10/13-10/25 1975	9
Atlanta	12/08-12/19 1975	16
Miami	2/09- 2/20 1976	16
Philadelphia	5/24- 6/05 1976	31
New York	8/16- 9/01 1976	40
Chicago	10/11-10/22 1976	41
Washington	*	40

* Various times during 1975-76, but mainly in July, September, and October of 1976.

TABLE 4

Power Densities at 193 Urban Sites

Site No. **	Description Location	North Latitude	West Longitude	Power Density by Band ($\mu W/cm^2$, except $n=nW/cm^2$, $p=pW/cm^2$) 0-2	LVHF	HVHF	FM	UHF	LLM	HLM	TOTAL
B01	Needham Heights	42 18 12	71 13 09	*	.53	.009	.51	.020	.013n	.	1.2
B02	Prudential Ctr.	42 20 51	71 04 57	.068	.0023	.0035	.0072	.88n	.66n	.060n	.015
B03	Boston Common	42 21 13	71 04 01	*	.0047	.021	.023	.0035	.063n	.0021	.054
B04	Haughton Pond	42 12 30	71 05 48	.14	.0075n	.088n	.0039	.013n	.04p	*	.0040
B05	Wellesley	42 18 43	71 15 48	*	.32	.017	.080	.011	*	*	.43
B06	Arlington Hgts.	42 24 51	71 10 50	*	.012	.022	.12	.14	*	*	.29
B07	Franklin Park	42 18 10	71 05 18	*	.0097	.046	.016	.10	*	*	.18
B08	Watertown-MBCC	42 22 16	71 12 40	*	.12	.050	.067	.074	*	*	.31
B09	Malden Hospital	42 25 42	71 05 20	*	.0061	.014	.011	.21	*	*	.052
A01	Piedmont Park	33 47 19	84 22 38	.94	.21	.0089	.17	.086	.05n	.19n	.47
A02	Maddox Park	33 46 17	84 25 30	.020	.0024	.0011	.0093	.0033	.24n	.09n	.016
A03	Collier Park	33 46 07	84 30 24	.0083	.0029	.53n	.0046	.87n	.006n	.001n	.0089
A04	College Park	33 39 20	84 27 03	.0022	.11n	.90n	.34n	.0039	.26n	.001n	.0055
A05	Lakewood Park	33 42 03	84 23 49	.012	.017	.024	.018	.054	.17n	.39n	.11
A06	Exchange Park	33 42 27	84 15 11	.077	.0011	.0053	.0028	.0017	.004n	.002n	.011
A07	Cobb City	33 54 12	84 29 12	.038	.0036	.0015	.0061	.0079	.001n	.001n	.019
A08	Parkview Plaza	33 44 48	84 19 41	.034	.054	.023	.023	.013	.0002	.0004	.11
A09	Treasure Island	33 46 37	84 14 40	.029	.0056	.0066	.012	.0017	.001n	.02n	.026
A10	Fernbank Center	33 46 44	84 19 05	.026	.051	.010	.040	.0025	.02n	.02n	.10
A11	CDC	33 47 48	84 19 38	.071	.046	.0037	.101	.039	.06n	.03n	.19
A12	Civic Center	33 45 57	84 22 45	.056	.066	.0027	.049	.066	.0012	.0003	.19
A13	Georgia Tech	33 46 39	84 23 59	.084	.016	.0019	.21	.073	*	*	.030
A14	Henderson Rd Pk	33 52 08	84 13 28	.089	.0035	.0031	.013	.0053	*	*	.025
A15	Doraville	33 54 05	84 16 43	.063	.0040	.016	.0069	.0041	*	*	.031
A16	Bolton Hospital	33 49 14	84 27 30	.011	.0039	.62n	.0084	.0041	.001n	.002n	.017
M01	Peacock Park	25 43 32	80 14 26	.040	.023n	.050n	.0018	.0057n	.001n	.005n	.0019
M02	Pace Park	25 47 39	80 11 12	.15	.18n	.0040	.064	.012n	.068n	.69n	.069
M03	Pepper Park	25 53 51	80 13 25	.058	.0039	.066	.035	.0031	.10n	.011n	.11
M04	NW 209th St.	25 58 01	80 12 12	*	.099	.18	.22	.0029	*	*	.50

TABLE 4 (cont.)

Site No.	Description Location	North Latitude	West Longitude	Power Density by Band ($\mu W/cm^2$, except $n=nW/cm^2$, $p=pW/cm^2$) 0-2	LVHF	HVHF	FM	UHF	LLM	HLM	TOTAL
M05	Tamiami Park	25 44 45	80 22 20	.035	.11n	.83n	.0038	.71n	.034n	.001n	.0055
M06	Bird Drive Park	25 43 59	80 18 40	.94	.048n	.72n	2.17	.097n	.025n	.027n	2.2
M07	Poinciana Park	25 50 24	80 14 24	.033	.011	.32n	.0040	.38n	.028n	.006n	.016
M08	Grapeland Park	25 47 16	80 15 23	.046	.11n	.0023	.0032	.43n	.42n	.068n	.0065
M09	Flamingo Park	25 46 56	80 08 18	*	.089n	.29n	.013	.016n	.006n	.023n	.013
M10	Matheson Hamm.	25 40 41	80 15 39	.034	.032n	.11n	. 2n	.020n	*	.03p	.0010
M11	Walker Park	25 50 50	80 18 02	.036	.21n	.0022	.043	.14n	.011n	.002n	.045
M12	NW 42nd Ave	25 56 21	80 16 09	.30	.0035	.056	.034	.92n	*	.022n	.094
M13	Greynolds Park	25 56 44	80 09 23	.025	.026	.044	.059	.41n	.17n	.055n	.13
M14	Diplomat Mall	25 59 11	80 07 47	.021	.012	.0080	.033	.0012	.009n	.095n	.054
M15	Westgate Mall	26 07 16	80 12 02	.036	.40n	.0018	.0037	.0012	.025n	.020n	.0071
M16	Bayfront Park	25 46 23	80 11 09	.20	.23n	.58n	.054	.018n	.0089	.0026	.066
P01	Domino Lane	40 02 39	75 14 12	.67	.70	.27	.73	.043	.05n	.11n	1.7
P02	Port Royal Rd.	40 03 33	75 14 24	.16	.64	.13	1.5	.27	*	*	2.5
P03	Allens Lane	40 02 44	75 12 35	.052	.096	.033	.11	.034	*	*	.27
P04	Ridge Ave.	39 59 36	75 11 22	.016	.0059	.0012	.020	.042n	.0055	.029n	.033
P05	E. Pk. Res'voir	39 58 53	75 11 26	.0067	.0082	.022	.017	.57n	*	*	.047
P06	16th & Norris	39 58 57	75 09 38	.021	.0017	.0025	.027	.0045	*	*	.036
P07	Connie Mack	39 59 47	75 10 00	.0033	.97n	.0088	.016	.0042	*	*	.030
P08	Ind. Mall	39 57 03	75 09 00	.0059	.27n	.64n	.038	.20n	.039n	.096n	.039
P09	Logan Circle	39 57 31	75 10 19	.0027	.99n	.70n	.041	.0012	*	*	.044
P10	Bala-Cynwyd	40 00 17	75 13 22	.041	.033	.0068	.097	*	.018n	.0026	.14
P11	Horticult. Hall	39 58 59	75 12 32	.056	.0024	.0032	.016	.45n	*	*	.022
P12	ECRI	40 07 09	75 15 44	.054	.30n	.0017	.0014	.0014	*	*	.0048
P13	Fern Hill Park	40 01 13	75 10 03	.0082	.0023	.0016	.0047	.21n	.027n	.15n	.0090
P14	Hunting Park	40 01 01	75 08 09	.018	.0041	.012	.0050	.0051	*	*	.026
P15	Broad St.	40 02 09	75 08 15	.0093	.025	.031	.022	.011	*	*	.089
P16	Aramingo St.	39 58 52	75 07 06	.016	.12n	.0012	.0074	.0033	*	*	.012
P17	Post Off. Annex	39 55 07	75 10 58	.0076	.43n	.0024	.045	.0022	.48n	.039	.051

TABLE 4 (cont.)

Site No.	Description Location	North Latitude	West Longitude	Power Density by Band ($\mu W/cm^2$, except $n=nW/cm^2$, $p=pW/cm^2$) 0-2	LVHF	HVHF	FM	UHF	LLM	HLM	TOTAL
P18	Navy Yard	39 53 28	75 10 17	.013	.13n	.33n	.47n	*	*	*	.00093
P19	Conshohocken	40 04 54	75 18 23	.028	.017	.0097	.015	.016	.015n	.009n	.058
P20	Lancaster Ave.	40 01 04	75 19 06	.0069	.35n	.39n	.78n	.38n	*	*	.0019
P21	Lawrence Pk Ctr	39 57 39	75 21 21	.0026	.0011	.0072	.0023	.10	.002n	.008n	.11
P22	Norristown Hosp.	40 07 55	75 20 49	.11	.82n	.0040	.070n	.0047	*	*	.0096
P23	Pennypack Park	40 04 43	75 02 42	.0021	.12n	.25n	.15n	.93n	*	*	.0015
P24	Wissinoming Pk.	40 01 24	75 04 15	.0086	.097n	.0013	.69n	.74n	.023n	.015n	.0029
P25	Holy Redeemer	40 06 35	75 05 04	.0013	.13n	.14n	.35n	.27n	*	*	.00089
P26	Highland School	40 07 22	75 07 23	.0023	.0016	.0041	.0051	.0471	*	*	.058
P27	Feasterville	40 08 30	75 00 09	.73n	.039n	.13n	.095n	.32n	.004n	.068p	.00065
P28	Filter Plant	40 02 22	74 59 59	.046	.074n	.0012	.26n	.056	*	*	.058
P29	Bridgewater	40 05 46	74 55 03	.0056	.048n	.37n	.13n	.0015	*	*	.0020
P30	Pathmark Center	39 54 31	75 05 55	*	.31n	.0074	.042	.039	.011n	.32n	.089
P31	Norwood Park	39 53 04	75 17 34	.0027	.35n	.85n	.29n	.39n	*	*	.0019
N01	Riverside Park	40 47 37	73 58 37	.042	.28n	.0011	.43n	.002n	*	*	.0018
N02	Central High	40 44 32	74 10 42	.018	.027n	.083n	.25n	.006n	.071n	.018n	.00046
N03	Essex Green Ctr	40 47 41	74 15 19	.025	.11n	.27n	1.9	.030	.14n	.25n	1.9
N04	Mt. Pleasant St.	40 47 16	74 15 15	*	*	*	4.6	.26n	*	*	4.6
N05	Channel 68 Tower	40 47 39	74 14 09	*	*	*	*	.35	*	*	.35
N06	Central Pk, So.	40 46 21	73 58 36	*	.032	.016	.080	.039n	*	*	.13
N07	Central Pk. N.	40 47 35	73 57 38	.085	.0090	.058	.018	.006n	.019n	.011n	.085
N08	Ft. Tryon Park	40 51 48	73 56 00	.10	.24n	.10n	.31n	.039n	*	*	.00069
N09	Randall's Is.	40 47 59	73 55 29	.068	.0031	.021	.0026	.0036	*	*	.030
N10	Battery Park	40 42 14	74 10 58	.036	.77n	.36n	.0010	*	.010n	.009n	.0021
N11	Foley Square	40 42 59	74 00 11	.031	.0071	.0065	.0048	.033n	*	*	.018
N12	E. River Pk.	40 43 08	73 58 31	.31	.010	.011	.012	.49n	.070n	.041n	.034
N13	McCarrey Park	40 43 15	73 57 04	.32	.14	.19	.25	.092n	*	*	.58
N14	Ft. Green Pk.	40 41 23	73 58 37	.0056	.0010	.0042	.0017	.36	.93n	.040n	.36
N15	Prospect Park	40 40 09	73 58 04	.0092	.0012	.0011	.63n	.33n	*	*	.0033
N16	Flatlands	40 37 35	73 55 39	.0086	.42n	.0017	.48n	.10n	.003n	.003n	.0027

TABLE 4 (cont.)

Site No.	Description Location	North Latitude	West Longitude	Power Density by Band ($\mu W/cm^2$, except $n=nW/cm^2$, $p=pW/cm^2$) 0-2	LVHF	HVHF	FM	UHF	LLM	HLM	TOTAL
N17	Fort Hamilton	40 36 21	74 01 42	.020	.015n	.083n	.051n	.084n	*	*	.00023
N18	Linden Blvd	40 39 37	73 53 10	.0055	.0011	.0013	.55n	.37n	.010n	.001n	.0033
N19	Shore Pkwy	40 35 02	73 55 48	.012	.27n	.0055	.61n	.0018	*	*	.0082
N20	Yankee Stadium	40 49 38	73 55 50	.062	.0018	.0029	.0020	.082n	*	*	.0068
N21	Fordham Univ.	40 51 35	73 53 17	.011	.13n	.26n	.027	.023n	.011n	*	.027
N22	Fordham Radio	40 51 24	73 52 54	*	*	*	.12	*	*	*	.12
N23	Van Cortland Pk	40 53 32	73 53 48	.049	.80n	.0069	.83n	.69n	*	*	.0092
N24	Cunningham Park	40 43 51	73 46 23	.033	.19n	.0020	.42n	.36n	.010n	.006n	.0030
N25	Great Neck	40 46 54	73 43 09	.029	.41n	.42n	.57n	.23n	*	*	.0016
N26	Flushing Meadow	40 44 09	73 50 15	.057	.0023	.071	.0068	.026	*	*	.11
N27	Aqueduct	40 40 37	73 49 40	.014	.50n	.0033	.0010	.36n	.0086n	.0079n	.0052
N28	Forest Park	40 42 19	73 50 21	.012	.0016	.52n	.59n	.042n	*	*	.0028
N29	Belmont Park	40 42 34	73 43 31	.0052	.055n	.0033	.35n	.37n	*	*	.0041
N30	White Plains Rd	40 49 31	73 51 34	.0095	.50n	.0014	.24n	.84n	.73p	.0020n	.0030
N31	Throgs Neck	40 49 47	73 48 54	.16	.10n	.96n	.095n	.35n	*	*	.0015
N32	Pelham Bay Park	40 52 11	73 47 49	.23	.26n	.0027	.48n	.0010	.64p	.0011n	.0044
N33	Woodmere	40 38 22	73 44 31	.0093	.18n	.0015	.30n	.0013	.0018n	.016n	.0033
N34	WIOK-FM	40 41 09	73 36 34	*	*	*	.22	*	*	*	.22
N35	Grand Ave Sch.	40 41 05	73 36 45	.028	.027n	.13n	.052	.76n	*	*	.053
N36	Mitchel Park	40 43 38	73 35 47	.011	.17n	.63n	.14	.033	*	*	.17
N37	Clove Lakes Pk	40 37 01	74 06 53	.017	.87n	.0012	.0015	.0035n	*	*	.0036
N38	Willowbrook Pk	40 36 15	74 09 36	.028	.26n	.38n	.48n	.16p	.57p	.0012	.0011
N39	Tottenville	40 30 08	74 15 47	.0043	.012n	.015n	.041n	.23p	*	*	.000068
N40	Great Kills Pk	40 32 37	74 07 35	.020	.27	.0023	.42n	.0029	*	*	.0059
C01	Buckingham Ftn	41 52 32	87 37 14	.0042	.017	.0059	.43	.0016	.017n	.26n	.46
C02	Kennedy Expy Mil	41 53 47	87 39 28	.014	.0071	.15	.17	.042	*	*	.37
C03	Kennedy Expy 46C	41 55 51	87 41 31	.034	.016	.16	.098	.031	*	*	.30
C04	Devon & Harlem	41 59 49	87 48 43	.098	.16n	.27n	.0013	.0011	*	*	.0028
C05	Lincoln Ave.	42 01 58	87 46 06	.094	.095n	.86n	.59n	.0024	.0084n	.0036n	.0040
C06	Devon Ave.	41 59 48	87 45 02	.042	.43n	.57n	.0032	.090n	*	*	.0043

TABLE 4 (cont.)

Site No.	Description Location	North Latitude	West Longitude	0-2	LVHF	HVHF	FM	UHF	LLM	HLM	TOTAL
				Power Density by Band (μW/cm^2, except n=nW/cm^2, p=pW/cm^2)							
C07	Addison	41 56 53	87 43 08	.085	.0032	.015	.037	.0056	*	*	.061
C08	Belmont	41 56 18	87 45 15	.33	.27n	.0013	.41	.16n	.0032n	.013n	.41
C09	WXRT	41 56 17	87 45 02	.045	*	*	10.9	*	.012n	.0079n	10.9
C10	O'Hare	41 58 36	87 53 39	.20	.072n	.038n	.0020	.32n	.0042	.029n	.0067
C11	Grand & Inland	41 55 58	87 54 59	.22	.017n	.14n	.0040	.15n	*	*	.0043
C12	Lake & Mill	41 55 58	88 00 04	.15	.020n	.56n	.013	.77n	*	*	.014
C13	Diversey & Mill	41 55 34	88 00 29	*	*	*	2.5	*	*	*	2.5
C14	Federal Bldg.	41 52 44	87 37 48	*	.0020	.0063	4.4	.0028	*	*	4.4
C15	Proviso West	41 50 10	87 54 06	.005	.13n	.58n	.65n	.0018	.0022n	.040n	.0031
C16	1004 Maple St.	41 52 12	87 48 12	.047	.13n	.0011	.0012	.23n	*	*	.002
C17	Near Sacremento	41 52 25	87 42 42	.025	.0028	.025	.021	.0093	*	*	.058
C18	I-90 at Ashland	41 52 31	87 40 01	.019	.013	.20	.21	.10	*	*	.52
C19	Water Tower	41 53 49	87 37 23	.0011	.091	.084	.18	.0090	.091n	.39n	.36
C20	Canal & Jackson	41 52 39	87 38 21	.017	.0049	.46	.43	.0058	*	*	.90
C21	Lake & Randolph	41 53 07	87 37 20	.15n	.089	.014	.69	.022	*	*	.82
C22	North Ave. Beach	41 54 46	87 37 30	.0076	.20	.019	.19	.036	*	*	.45
C23	Cermak Rd.	41 51 10	87 38 08	.0088	.015	.41	.35	.041	.031n	.48n	.82
C24	35th & Pershing	41 49 49	87 37 51	.014	.011	.12	.079	.020	*	*	.23
C25	Ryan Expy #7	41 45 58	87 37 34	.012	.35n	.013	.0020	.0050	*	*	.020
C26	I-94 near 115th	41 41 01	87 36 08	.011	.046n	.0026	.76n	.011	*	*	.014
C27	Calumet Park	41 43 22	87 31 30	.011	.27n	.0025	.0012	.0014	*	*	.0053
C28	Rainbow Park	41 45 12	87 32 43	.010	.0050	.026	.0024	.014	*	*	.043
C29	Science Museum	41 47 26	87 43 49	.0076	.16n	.56n	.58n	.16n	.070n	.0013n	.0015
C30	Planetarium	41 51 57	87 36 33	.015	.072	.11	.26	.025	*	*	.47
C31	119th & Western	41 40 38	87 41 00	.014	.024n	.21n	.27n	.071n	*	*	.00058
C32	Greenoak Center	41 43 07	87 44 25	.017	.022n	.0011	.28n	.0012	.67p	.20n	.0028
C33	Ford City Ctr.	41 45 26	87 44 28	.028	.16n	.65n	.47n	.73n	*	*	.0020

TABLE 4 (Cont.)

Site No.	Description Location	North Latitude	West Longitude	Power Density by Band ($\mu W/cm^2$, except n=nW/cm^2, p=pW/cm^2) 0-2	LVHF	HVHF	FM	UHF	LLM	HLM	TOTAL
C34	71st & Western	41 45 51	87 40 58	.075	.58n	.0029	.0018	.0025	*	*	.0078
C35	63rd & 73rd	41 46 40	87 46 12	.019	.035n	.38n	.30n	.56n	*	*	.0013
C36	Cicero Ave	41 49 18	87 44 08	.054	.89n	.0058	.0035	.0012	*	*	.011
C37	Pershing	41 49 24	87 40 55	.039	.0017	.0034	.0081	.54n	.0020n	.026n	.014
C38	Grosse Point	42 03 53	87 40 33	.013	.086n	.47n	.0014	.43n	.52p	.0037	.0024
C39	Loyola U.	42 00 02	87 39 30	.013	.032n	.052n	.68n	.0061n	*	*	.00077
C40	Addison	41 57 00	87 38 21	.011	.028	.080	.10	.013	*	*	.22
C41	Fullerton	41 55 05	87 38 09	.012	.060	.15	.32	.073	.021n	.37n	.60
W01	9100 Brookville	39 00 22	77 03 07	.23	.0025	.010	.033	.066	.008n	.008n	.11
W02	Sibley Hosp.	38 56 12	77 06 38	.0033	.20	.012	.21	.046	*	*	.46
W03	NBS	39 08 09	77 12 55	*	*	*	.12n	*	*	*	.00012
W04	Holy Cross Hosp.	39 00 51	77 02 12	*	.0019	.011	.042	.89n	.029	.0042	.056
W05	Waterside Mall	38 52 08	77 01 09	.23n	.0037	.087n	.0071	.054n	.84p	.0053n	.011
W06	Fessenden St.	38 57 18	77 04 55	*	1.49	.77	1.19	.026	*	*	3.5
W07	Westwood	38 57 53	77 06 11	*	.81	.19	.79	.40	*	*	2.2
W08	Somerset Hts.	38 58 07	77 05 31	*	.088	.097	.27	.18	*	*	.63
W09	Willow Lane	38 58 54	77 05 29	*	.087	.13	.13	.016	*	*	.36
W10	Jones Br & Wisc	38 59 49	77 05 47	*	.025	.010	.13	.54n	*	*	.17
W11	Locust Hill	39 00 38	77 05 47	*	.012	.0013	.025	.058	*	*	.097
W12	Grosvenor & 355	39 01 25	77 06 15	*	.0024	.0035	.0047	.0023	*	*	.013
W13	Flanders & 355	39 02 20	77 06 25	*	.98n	.42n	.0047	.0054	*	*	.011
W14	Montrose & 355	39 03 11	77 06 55	*	.0023	.0079	.0047	.0075	*	*	.022
W15	Congress. Plaza	39 03 16	77 07 32	*	.0017	.0020	.0024	.041	*	*	.047
W16	Edmonston & 355	39 04 05	77 08 14	*	.88n	.11n	.30n	.0049	*	*	.0062
W17	Beall Ave & 355	39 05 13	77 09 05	*	.0012	.0030	.0018	.013	*	*	.019
W18	Redland & 355	39 06 53	77 09 48	*	.42n	.17n	.30n	.13n	*	*	.0010
W19	Gaithersburg	39 08 40	77 12 12	*	.044n	.060n	.13n	.70n	*	*	.00093
W20	Brink & 355	39 12 23	77 14 49	*	.056n	.015n	.088n	.048	*	*	.00021
W21	Clarksburg-355	39 14 50	77 17 48	*	.0056n	.014n	.038n	.094n	*	*	.00015
W22	Urbana-355	39 20 38	77 22 31	*	.010n	.036n	.56n	.34n	*	*	.00095
W23	Brentwood Park	38 54 32	76 59 47	.065	.021	.028	.018	.011	.020n	.18n	.078

TABLE 4 (Cont.)

Site No.	Description Location	North Latitude	West Longitude	Power Density by Band ($\mu W/cm^2$, except $n=nW/cm^2$, $p=pW/cm^2$) 0-2	LVHF	HVHF	FM	UHF	LLM	HLM	TOTAL
W24	G.W. Pkwy.	38 55 36	77 06 58	.0075	.38	.054	.27	.024	*	*	.73
W25	Grant Square	38 56 38	77 01 24	.013	.052	.016	.050	.0049	.034n	.038n	.12
W26	Great Oaks Ctr	39 03 03	76 58 47	.0025	.34n	.0011	.40n	.0040	*	*	.0058
W27	Aspen Hill	39 04 47	77 04 24	.0050	.21n	.0012	.0013	.0016	.0018n	.08p	.0043
W28	Montgomery Mall	39 01 25	77 08 39	.21	.0087	.0068	.011	.077	.018n	.13n	.10
W29	Tysons Corner	38 55 08	77 13 06	.0066	.038	.061	.047	.12	.012n	.0013	.27
W30	Little River	38 49 54	77 12 12	.0047	.61n	.77n	.0032	.0020	.52p	.0045n	.0066
W31	Baileys X-roads	38 50 53	77 06 48	.0026	.0075	.0052	.0094	.0024	*	*	.025
W32	Riggs & Univ.	38 59 01	76 58 48	.033	.0012	.30n	.0025	.0012	.23p	.012n	.0052
W33	Duval High	38 59 24	76 50 11	.58n	.52n	.26n	.57n	.0076	.08p	.1p	.0089
W34	Prince Geo. Hosp	38 55 32	76 55 29	.0082	.043	.0024	.024	.0045	.028n	.0074n	.074
W35	Andrews AFB	38 49 04	76 53 30	.0026	.0070	.0015	.0051	.0015	.0037n	.2p	.015
W36	Phelps Corner	38 48 20	76 58 31	.0024	.0080	.023	.0097	.0051	*	*	.046
W37	Cameron Station	38 48 33	77 07 22	.0033	.74n	.068n	.0014	.14n	.0011n	.0018	.0041
W38	National Mall	38 53 20	77 01 06	.018	.0015	.93n	.0068	.34n	.0011n	.023n	.0095
W39	Nat. Airport	38 51 01	77 02 33	.0044	.0049	.019	.0080	.017	.012n	.12n	.049
W40	Halls Hill	38 53 48	77 07 43	.16	.0014	.0062	.20	.024	.085n	.0013	.23

* Band not measured at this site.

** B = Boston
A = Atlanta
M = Miami
P = Philadelphia
N = New York
C = Chicago
W = Washington

TABLE 5

Metropolitan Area Definitions

City	Boundaries: Latitude	Boundaries: Longitude	Population
Boston	42° 09' - 42° 30'	71° 00' - 71° 24'	1960000
Atlanta	33° 30' - 34° 00'	84° 12' - 84° 36'	1220000
Miami	25° 30' - 26° 12'	80° 06' - 80° 30'	1660000
Philadelphia	39° 51' - 40° 12'	74° 57' - 75° 24'	3410000
New York	40° 30' - 41° 00'	73° 36' - 74° 18'	12270000
Chicago	41° 42' - 42° 06'	87° 30' - 88° 00'	4740000
Washington	38° 44' - 39° 08'	76° 48' - 77° 20'	2520000

TABLE 6

Radiofrequency Radiation Standards

BAND	EXPOSURE TIME (hours)	USSR	COUNTRY CZECH.	POLAND	USA ANSI	USA AIR FORCE
Above 300 MHz	24		.0025	.01		
	8-10	.01	.025	.20	10	10
(power density	2	.10	.10	.40	10	10
in mW/cm^2)	.33	1.0	.60	.98	10	10
	.10	1.0	2.0	1.79	10	10
	2 min.	1.0	6.0	3.1	30	30
30-300 MHz	24		1	7		
	8-10	5a	10	20	197	197
(field strength	2		40	40	197	197
in Volts/meter)	.33		240	98	197	197
	.10		800	179	197	197
	2 min.		2400	300	336	336
10-30 MHz	24		5	7	197	197
			50	20	197	197
			200	40	197	197
			1200	98	197	197
			4000	179	197	197
			12000	300	336	336
.1-10 MHz	24		5	20		
	8-10	50b	50	70	c	434
	2		200	280	c	434
	.33		1200	1000	c	434
	.10		4000	1000	c	434
	2 min.		12000	1000	c	752

a In the 30-50 MHz band, 10 V/m is allowed.
b In the 3-30 MHz band, 20 V/m is allowed.
c No standard or standard not applicable.

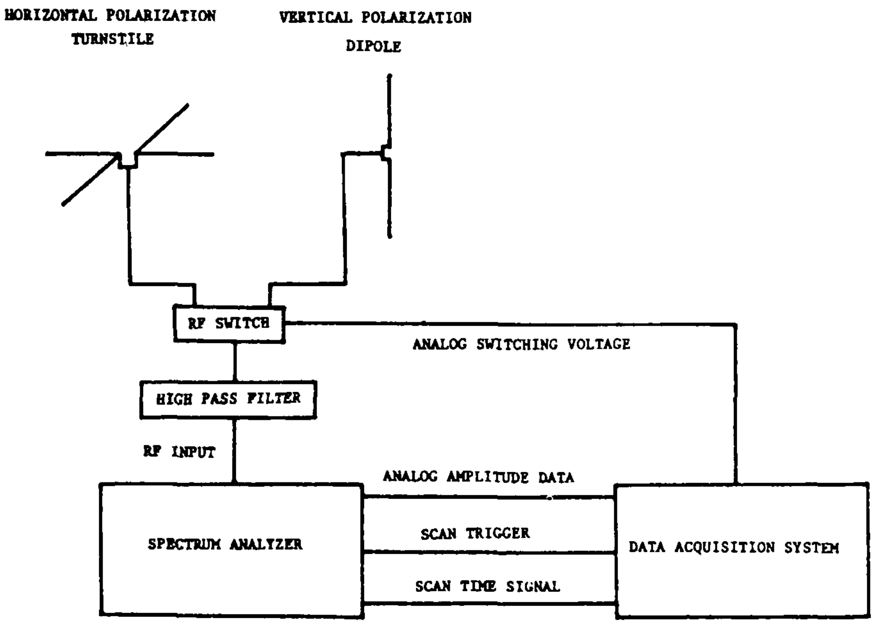


Figure 1. Block diagram of measurement system.

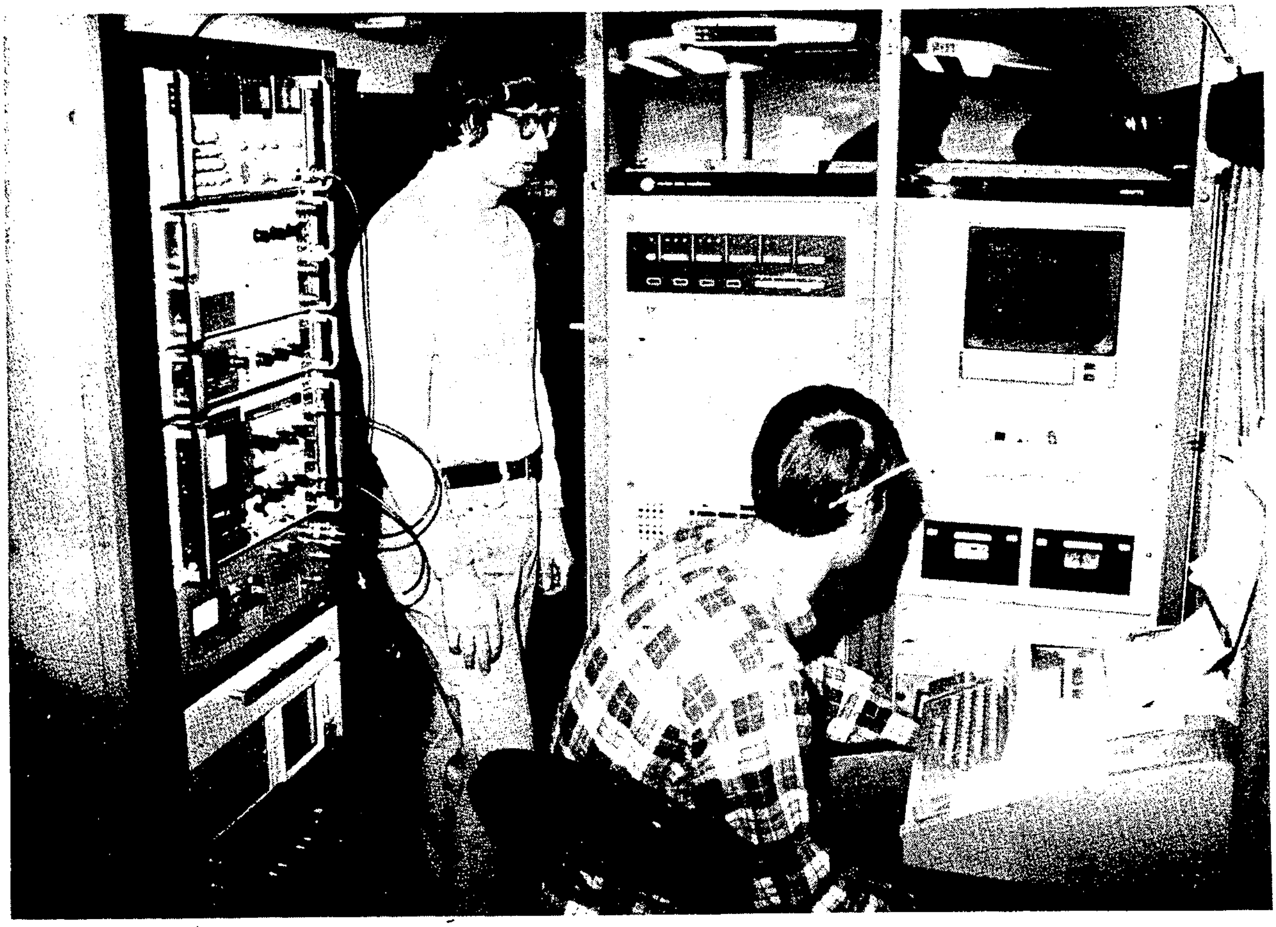


Figure 2. Radio-frequency detection equipment and minicomputer inside equipment van.

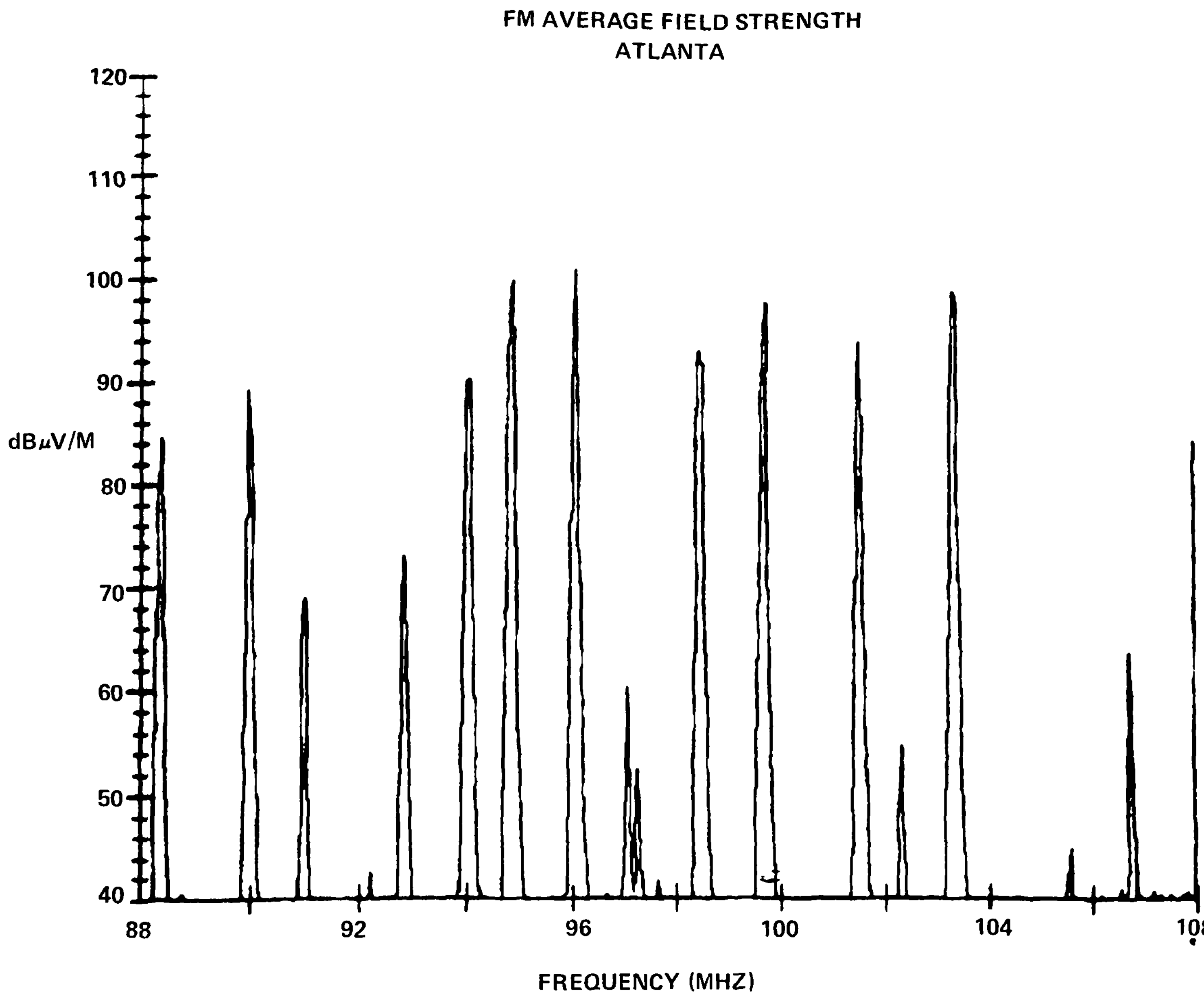


Figure 3. The FM radio spectrum at a site in Atlanta

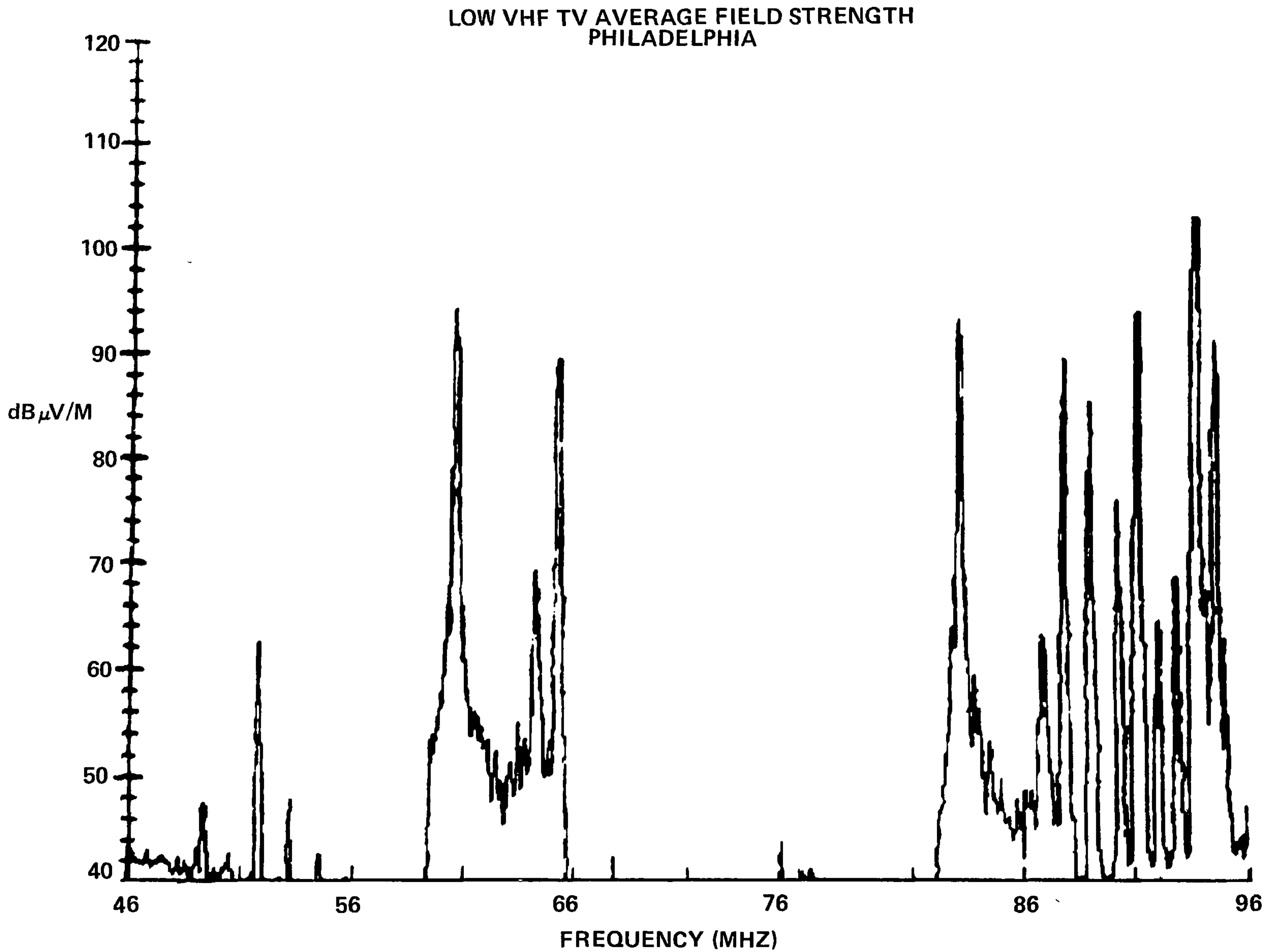


Figure 4. The lower VHF television band spectrum at a site in Philadelphia

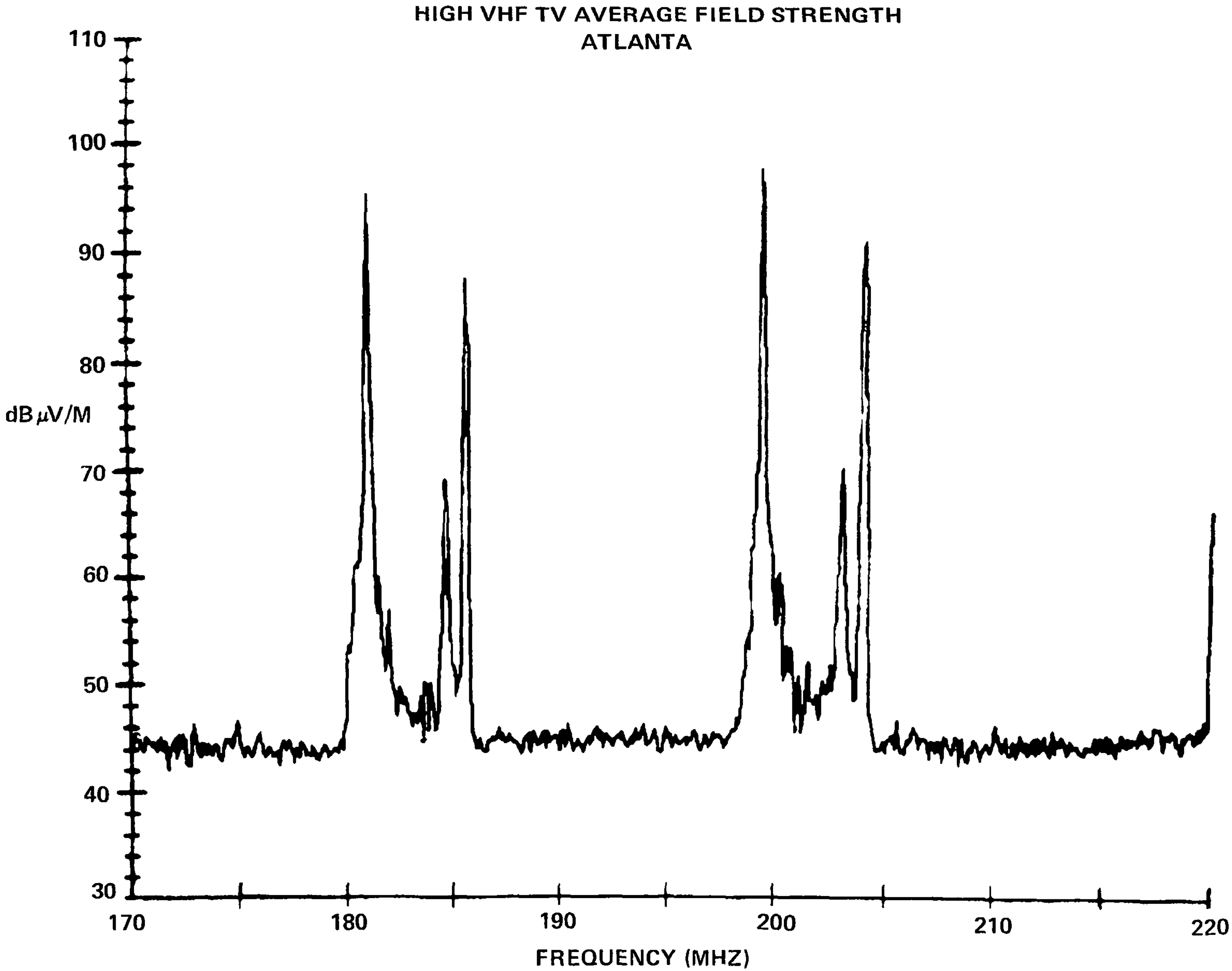
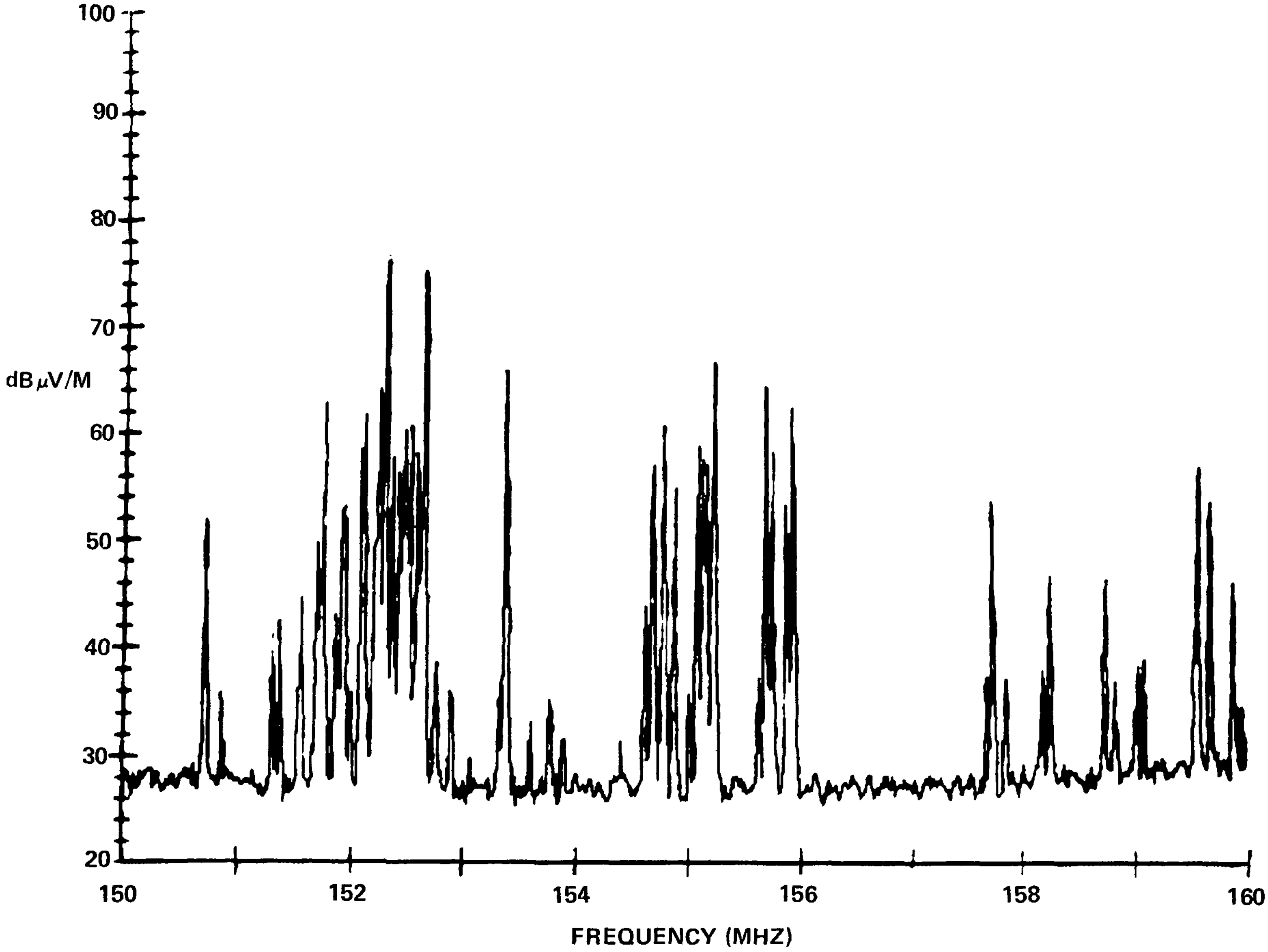


Figure 5. The upper VHF television band spectrum at a site in Atlanta.

VHF LAND MOBILE AVERAGE FIELD STRENGTH
MIAMI



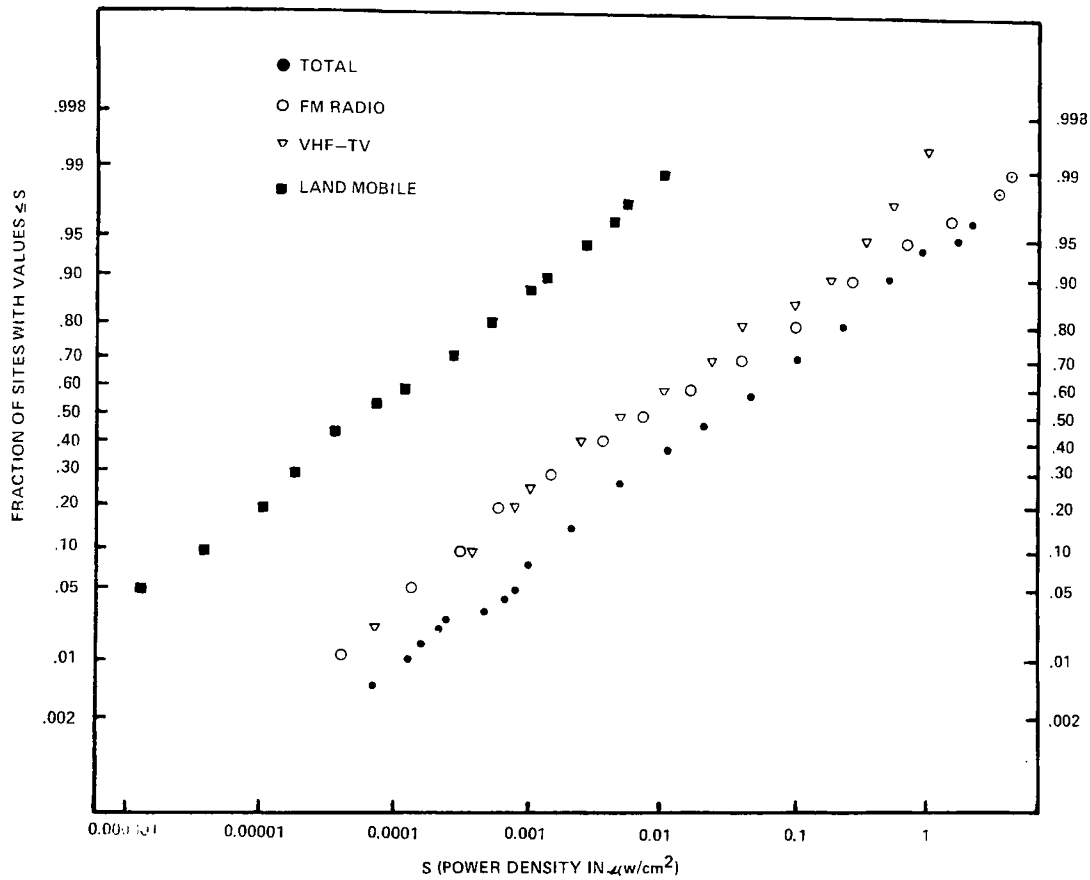


Figure 7. Distribution of power densities at 193 measurement sites (for clarity, not all points are plotted).

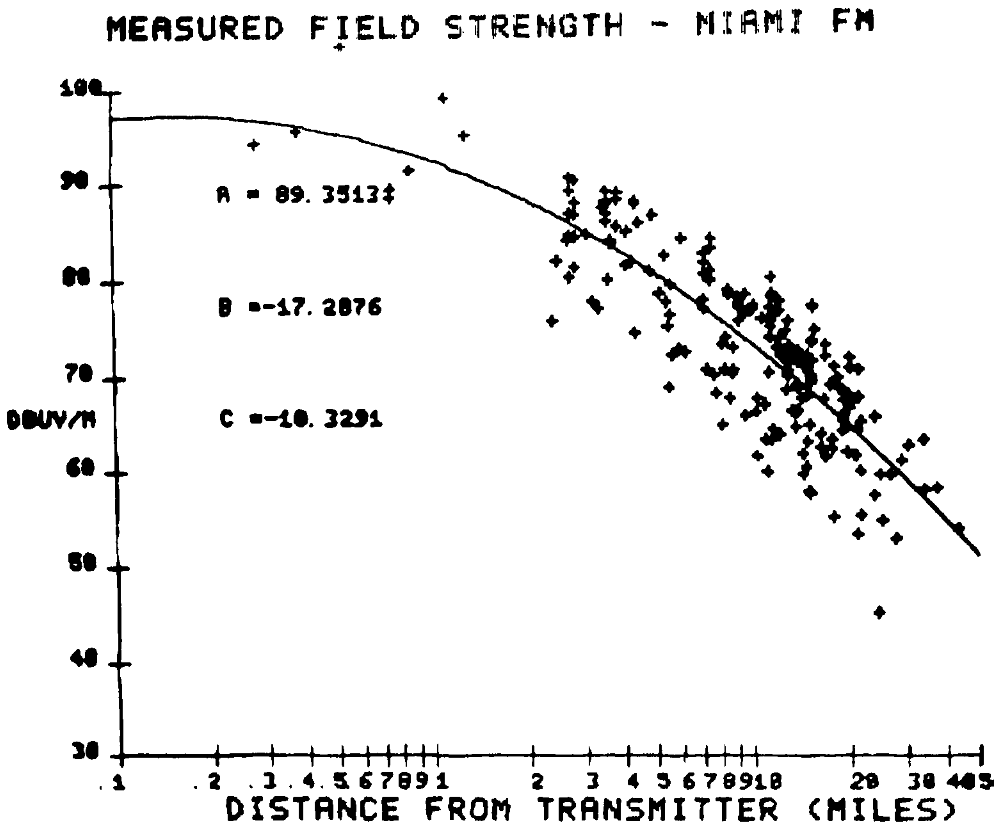


Figure 8. Distribution of field strengths as a function of distance from Miami FM radio transmitters.

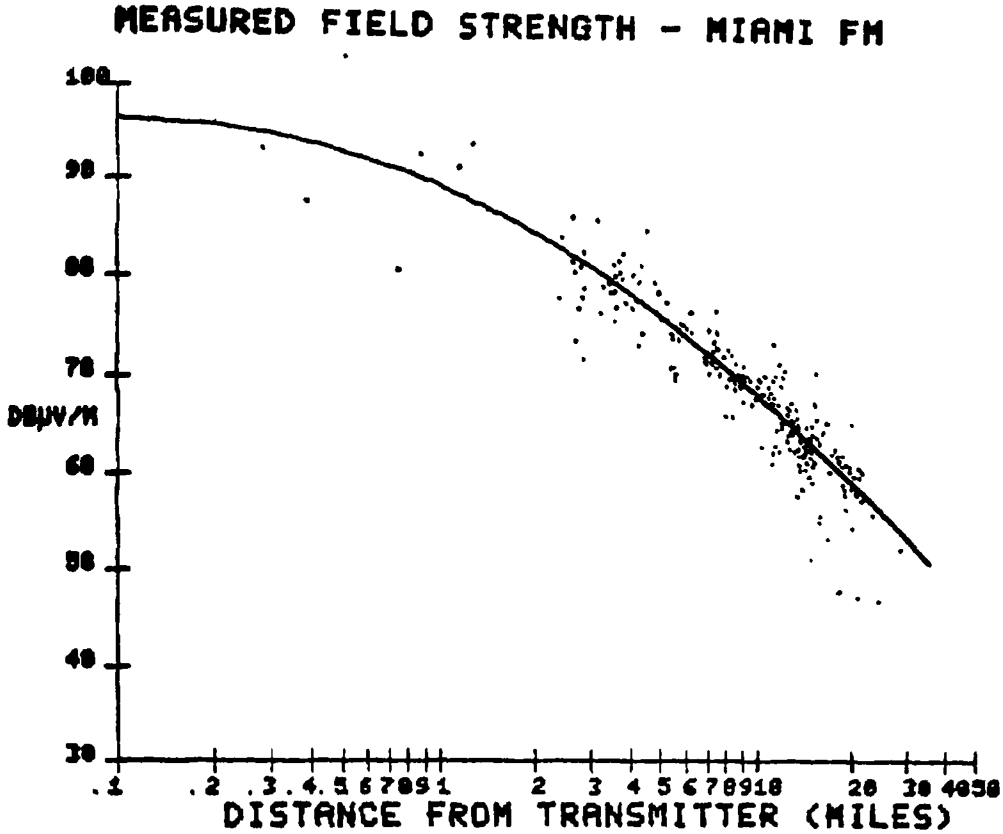


Figure 9. Relative field strengths from Miami FM radio transmitters. The points from each transmitter are fit as a group to the given parabola.

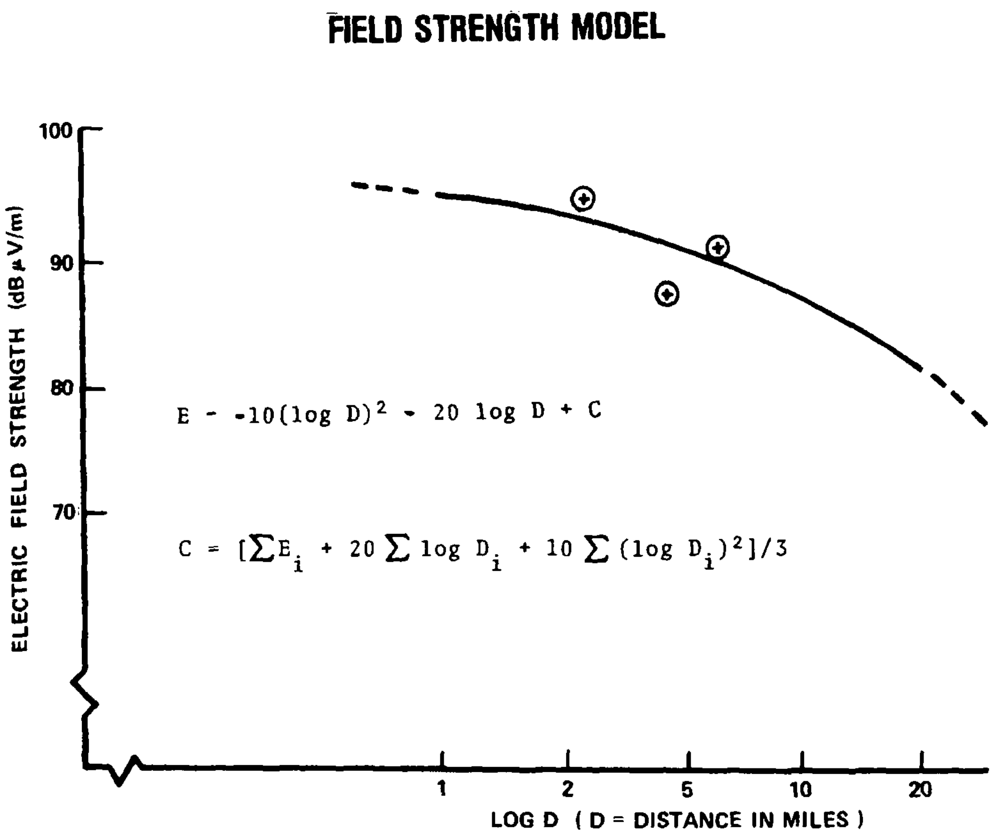


Figure 10. The field strength model.

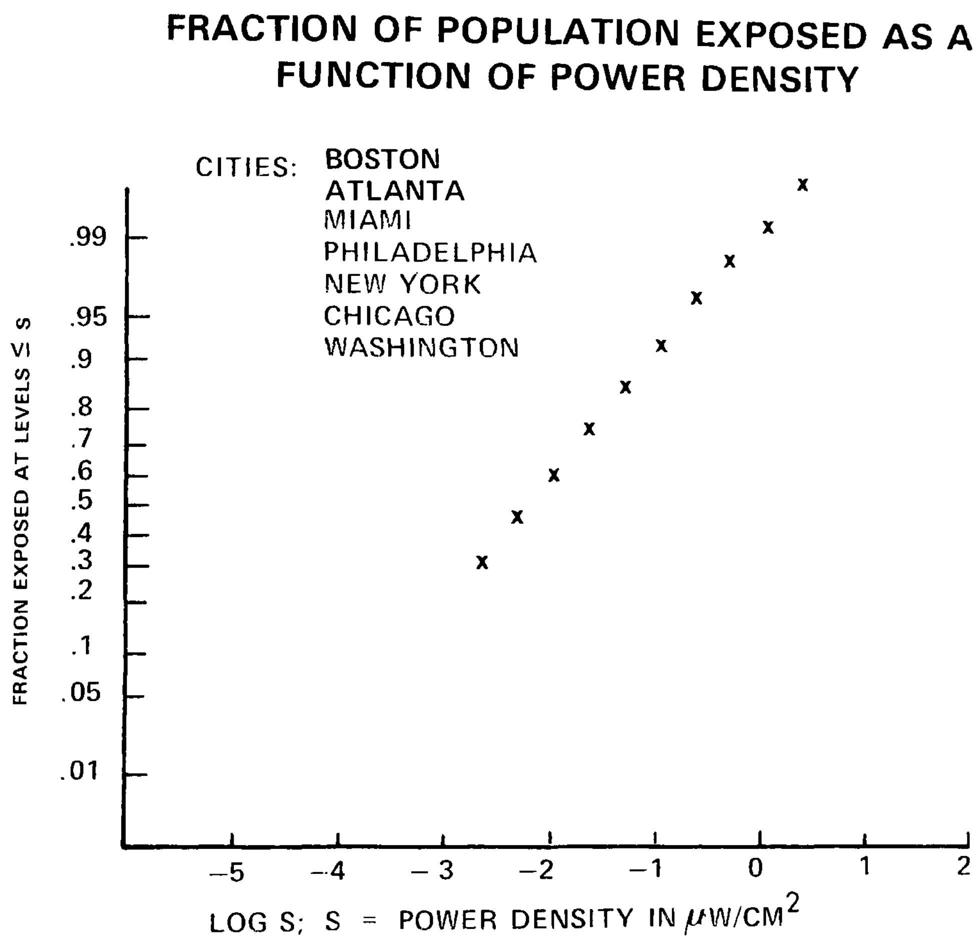


Figure 11. The fraction of the population in seven eastern cities exposed at various power densities. Zero on the horizontal axis corresponds to one microwatt per square centimeter, -1 corresponds to 0.1 microwatts per square centimeter, etc.

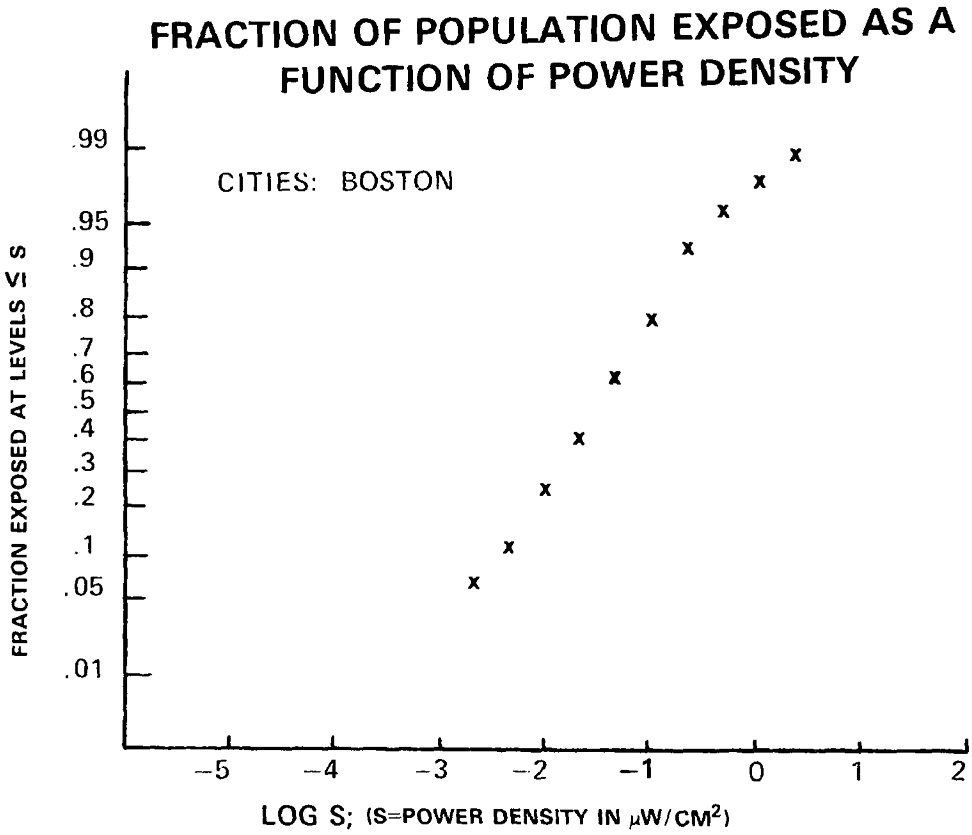


Figure 12. The fraction of the population exposed at various power densities in Boston.

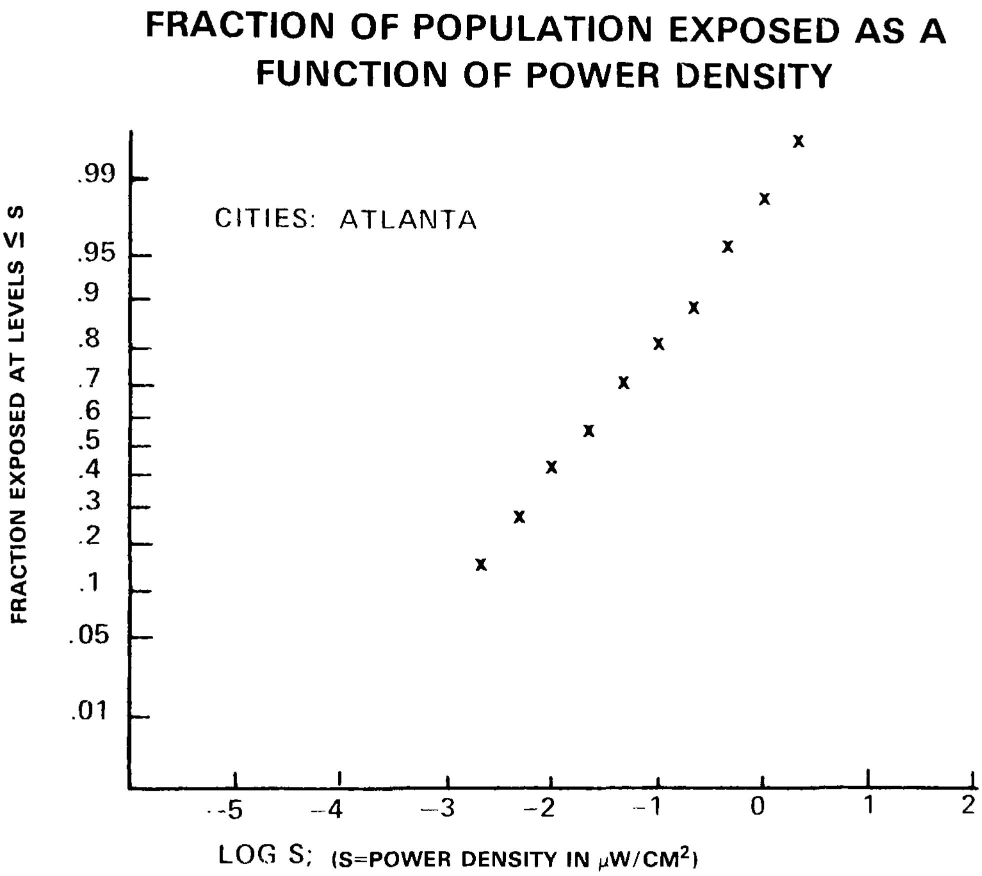


Figure 13. The fraction of the population exposed at various levels in Atlanta.

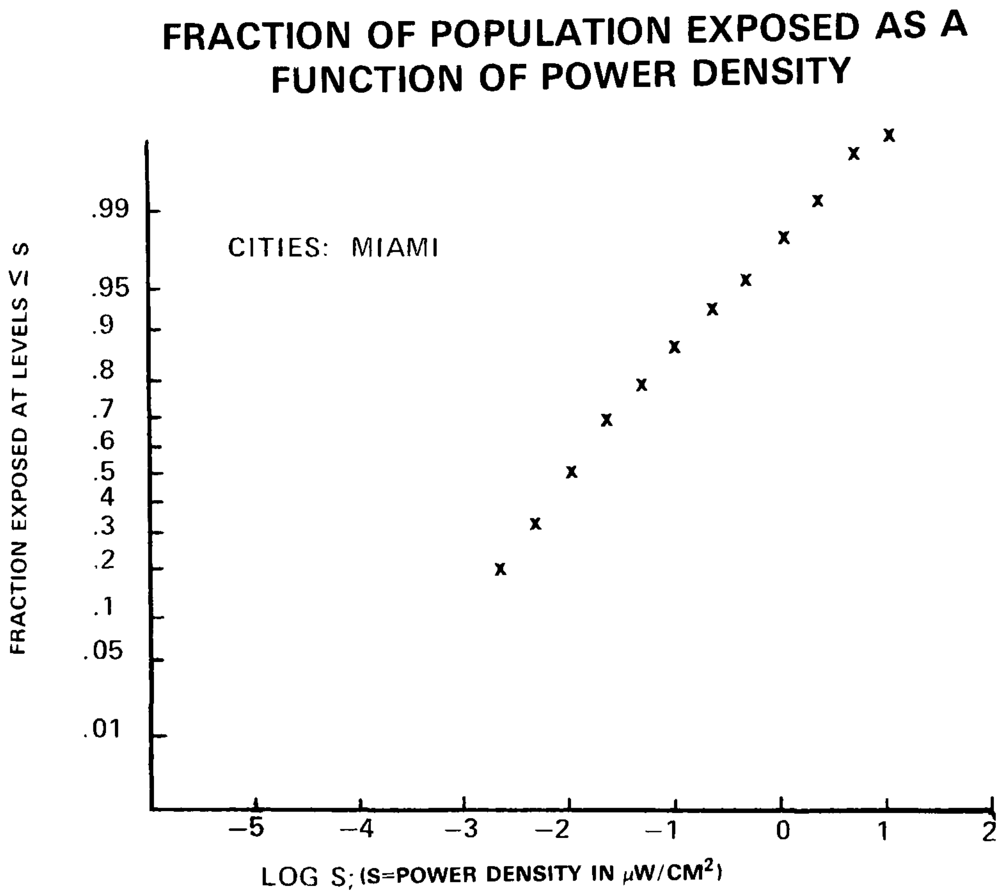


Figure 14. The fraction of the population exposed at various levels in Miami.

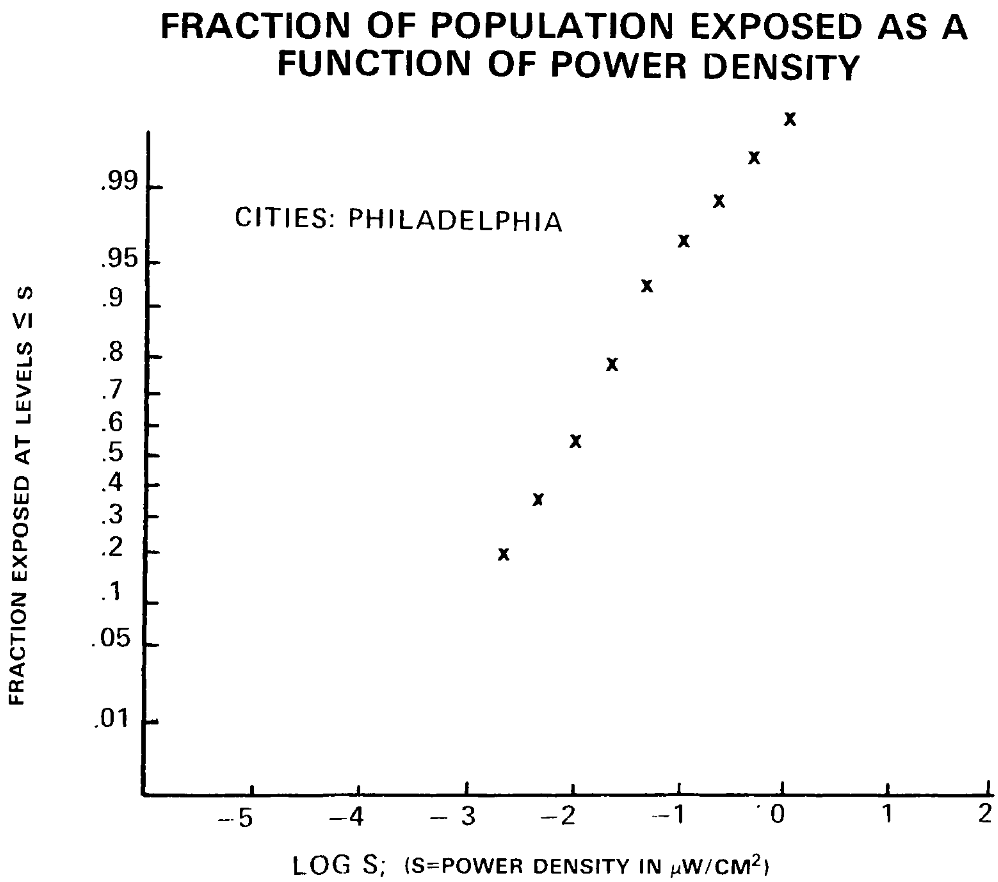


Figure 15. The fraction of the population exposed at various levels in Philadelphia.

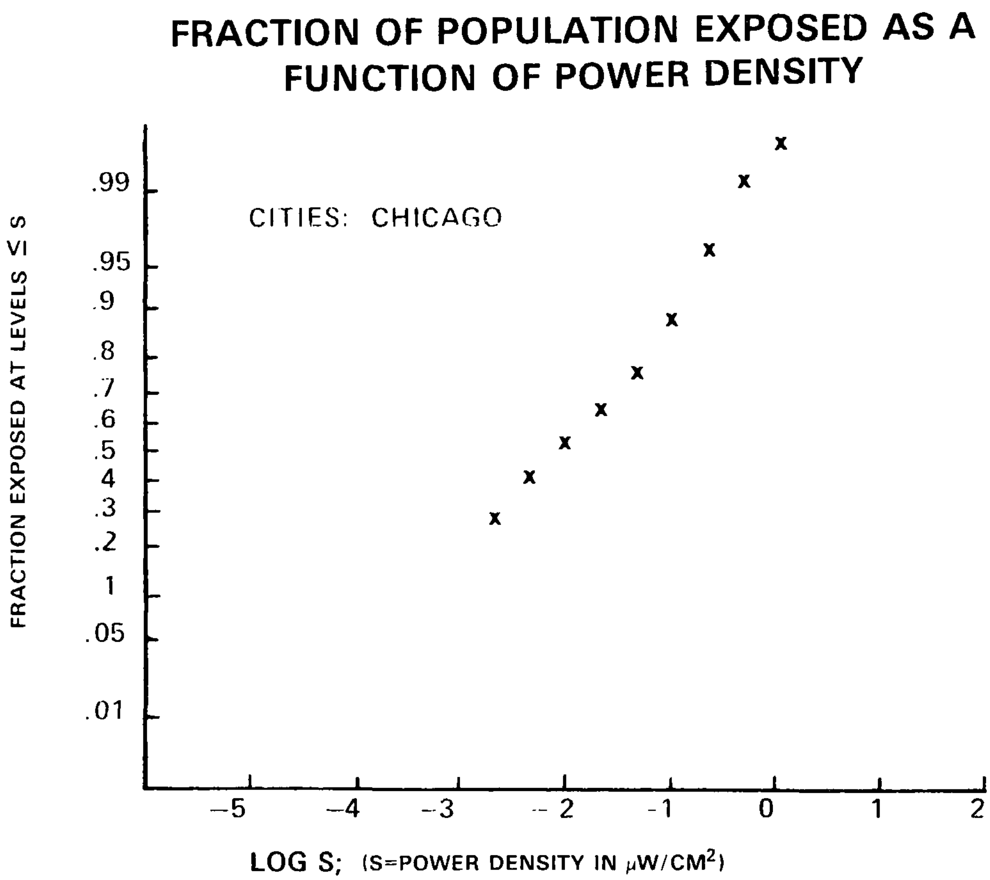


Figure 16. The fraction of the population exposed at various levels in Chicago.

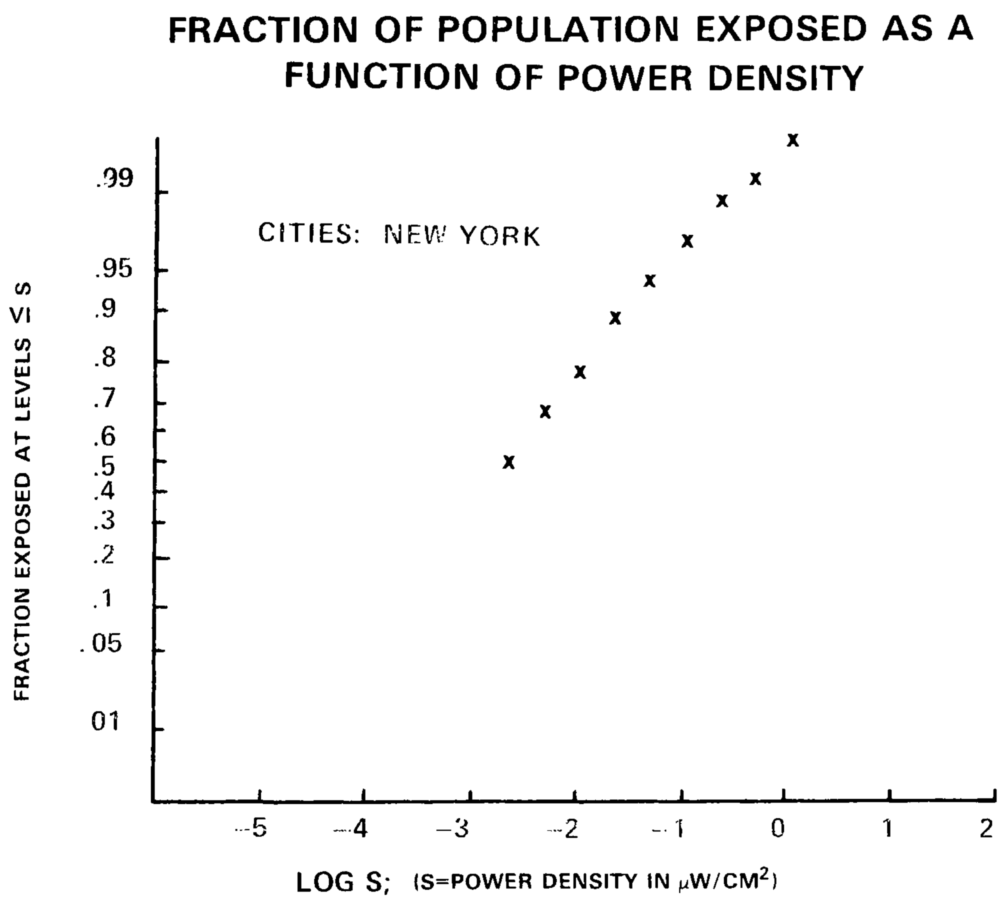


Figure 17. The fraction of the population exposed at various levels in New York.

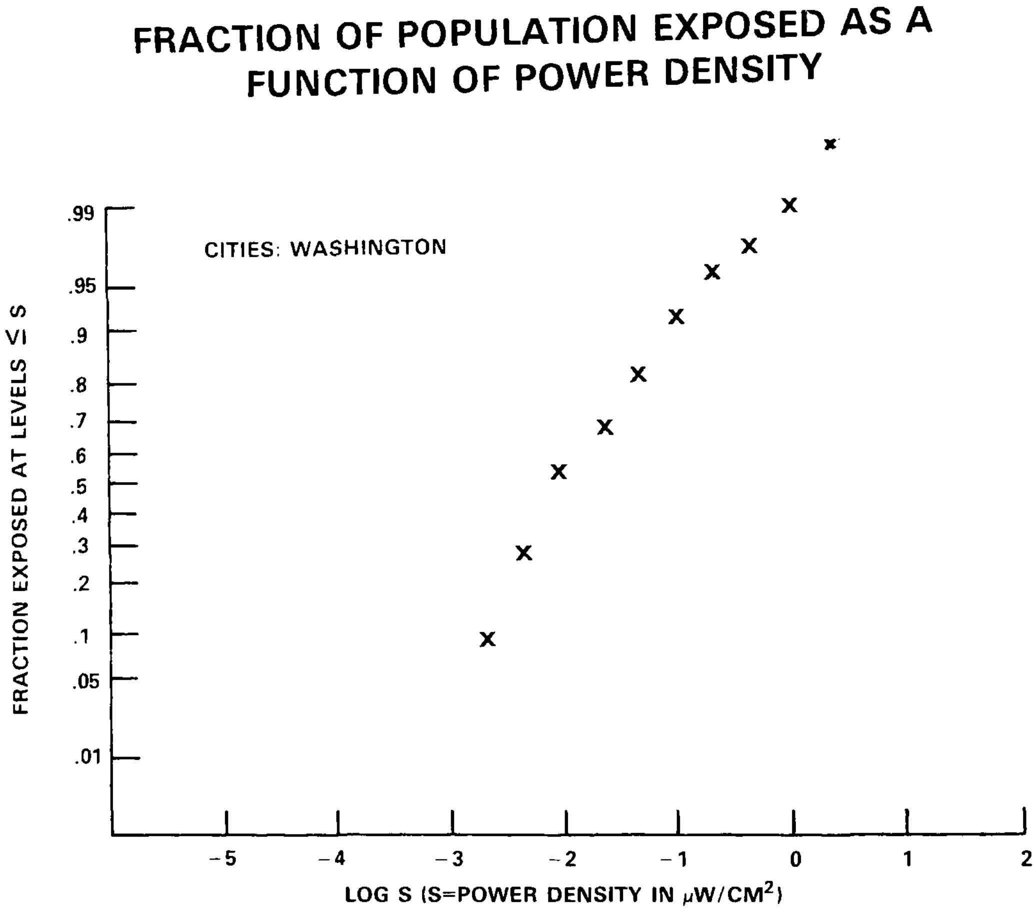


Figure 18. The fraction of the population exposed at various levels in Washington, D.C.

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ORP/EAD 78-1	A Comparison of Measurement Techniques to Determine Electric Fields and Magnetic Flux Under EHV Overhead Power Transmission Lines (NTIS Order No. pending)
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