FCC/FOB/PD&E 77-02

Program Development & Evaluation Staff
Field Operations Bureau

THE EXTENT AND NATURE OF TELEVISION RECEPTION DIFFICULTIES ASSOCIATED WITH CB RADIO TRANSMISSIONS

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Federal Communications Commission
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EXECUTIVE SUMMARY

The recent rapid growth of Citizens Band (CB) Radio Service has been accompanied by a corresponding increase in the number of complaints filed by the general public with the Federal Communications Commission involving interference to television reception associated with CB operation. Through analysis of on-site observations, this study defines the various factors contributing to these CB-TV interference complaints and presents them in a manner that can be used to improve present FCC complaint-handling procedures and, perhaps, eventually eliminate the fundamental causes of such complaints.

This report is somewhat unique in that it is based on actual interference situations which have been reviewed and investigated "in the field." Previous evaluations of interference situations have been concerned primarily with test data produced in laboratory environments--not real-life situations.

In Fiscal Year 1976, a lower bound on the number of individuals experiencing interference to TV reception associated with the operation of CB stations probably lies somewhere between one and ten million persons, with the best estimate being four million persons. Projections for Fiscal Year 1979 are that between 3-21 million persons (best estimate--9 million) will experience TVI associated with CB radio operation. The principal factors involved in such interference appeared to be: (1) inadequate CB transmitter harmonic suppression; (2) inadequate TV

receiver selectivity (overload); and (3) illegal use of external radio frequency (rf) power amplifiers (linears).

In the following paragraph the relative impact of various interference causes is indicated. Note that the total does not add to 100 percent but this is expected because many cases could be resolved by more than one action and many cases exhibit overlapping causes.

Approximately 55 percent[1/] of CB-TV interference complaints were partially attributable to inadequate transmitter harmonic suppression, and the present 60 dB requirements are not sufficient to prevent all cases of this type of interference.

Approximately 45 percent[1/] of CB-TV interference complaints were partially attributable to 27 MHz fundamental overload of the TV receiver.

If all CB stations employed a low-pass filter and all TV receivers employed a high-pass filter, approximately 40 percent of all CB-TV interference would be resolved and an additional 30 percent improved.

When interference occurred, sufficient to generate a complaint, it degraded TV reception to an unacceptable level in approximately 70 percent of the cases.

Linear amplifiers were associated with approximately 45 percent of all CB-TV interference cases. The average linear ampli-

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1/ This figure is based on the assumption that 80 percent of all TV viewers regularly view TV channel 2, 5, 6 or 9. These TV channels are harmonically related to the CB channel transmitting frequencies.

fier power output was 120 watts or ERP 700 watts (as most stations of this type use a high-gain antenna).

It is estimated that eliminating linear amplifiers would resolve 25 percent of all CB-TV interference problems and improve an additional 20 percent--possibly to the point of not being objectionable.

It would require approximately 430 manyears[2/] of unannounced monitoring to detect only 50 percent of the linear amplifiers in use and associated with a CB-TV interference complaint.

Thirty-five percent of the CB-TV interference complaints in this study were located within 50 feet of the CB operator and 80 percent within 200 feet. These distances varied directly with the use or nonuse of a linear amplifier or high-gain antenna.

Most CB-TV interference was restricted to TV channels 2, 5 and 9[3/] because of the 27 MHz harmonic relationship.

This study indicates that CB-TV interference is a complex problem whose resolution will require coordinated action by all parties concerned.

In view of the very active interest in this report which has been expressed by the electronics industry, communications users and government organizations, a considerable quantity of background material and other "raw data" is presented to facilitate review of the above-mentioned findings by all parties.

2/ Travel and administrative time excluded.

3/ Forty-channel CB units will also affect TV channel 6.

INTRODUCTION

Background

Radio frequency (rf) emissions are frequently intercepted on electronic equipment not designed or intended to receive the signals.[4/] The most common category of complaint filed with the Federal Communications Commission's Field Operations Bureau (FOB) involves the interception of unwanted radio signals by home electronic entertainment equipment (HEEE).[5/] Radio transmissions interact with electronic equipment and such interactions have resulted in interference complaint problems since the earliest days of radio. Prior to 1950, AM radio was the principle HEEE device operated by the general public. During those and subsequent years, FCC field staff gained experience in evaluating compatibility problems including overload, audio rectification, IF pick-up, co-channel and adjacent channel interference. Actual on-site investigations by Commission field engineers were made in many of the cases. The relatively small number of complaints (7,000 to 8,000 per year during the late 1940's) and a much smaller work-load involving other matters allowed for individual on-site investigation of a significant percentage of the complaints and personal advice to the complainant of the exact steps necessary to eliminate the interference.

4/ During Fiscal Year 1976, FCC field installations received 80,816 complaints of electromagnetic interference. It is projected that more than 100,000 complaints will be received during Fiscal Year 1977. See Figure 1 on p. 4.

5/ Home Electronic Entertainment Equipment (HEEE) includes AM, FM, TV, and other receivers, audio devices such as tape recorders, electronic organs, phonographs and other electronic equipment commonly used in the home. Seventy-six percent of all complaints of interference received in Fiscal Year 1976 involved HEEE.

With the wide acceptance of television beginning in the early 1950's and its accompanying visual disruptions caused by interfering signals, the number of complaints increased to over 21,000 during Fiscal Year 1953. This number exceeded the capability of FOB to respond to each complaint on-the-scene; therefore, response to many of the complaints became limited to correspondence.[6/]

During the early 1960's, the number of interference complaints continued to increase and correspondence became the primary method of response, although some severely aggravated complaints were investigated on-the-scene as other priorities permitted--a procedure which continues today. Experience obtained by on-site investigation shows that most HEEE interference problems could be adequately diagnosed by analyzing a description of the aural or visual effects of the reception problem. Also, experience indicated a high percentage of interference problems involved deficiencies in the design and/or installation of the complainant's system--that is, it did not have sufficient unwanted radio frequency signal rejection capability. The solution to the majority of such problems is the addition of rf filtering and shielding to the affected device.

6/ This method of handling complaints of interference to HEEE relies upon initial analysis of the problem and transmittal of guidance to the complainant and licensee of any radio station involved. This method relies extensively upon cooperation between the subject (CB station operator) and the complainant (affected TV viewer that filed complaint) and their service technicians to follow FCC recommendations to achieve resolution.

During the late 1960's and early 1970's, the nature of the interference problem began to change and the complaint rate began to increase dramatically. These changes are directly related to: (1) the tremendous growth of the Citizens Band (CB) Radio Service (see figure 2 on p. 4);[7/] (2) the rapidly increasing use of semiconductor technology in electronic devices; and (3) the growing use of consumer electronics in daily life.

It is because of the increased growth rate and changing nature of interference complaints, as well as the Bureau's desire to respond to the complaints, consider equities of all parties concerned and available alternatives, and make recommendations or take action to resolve the problems, that this study was conducted.

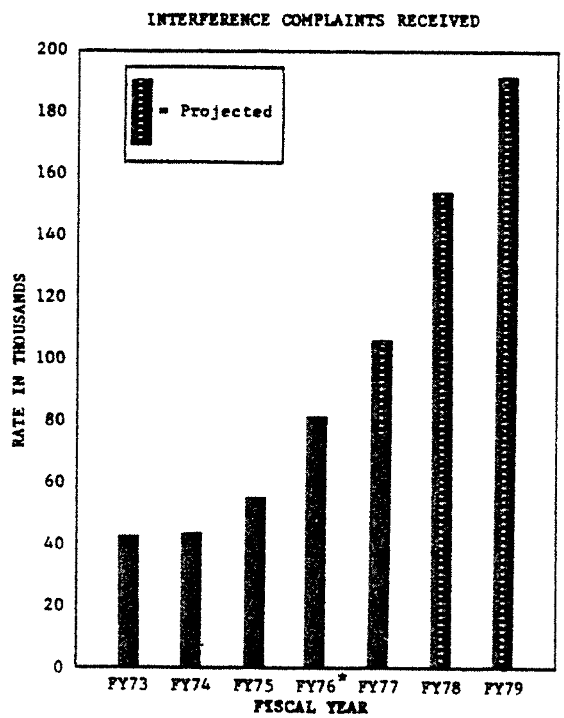
Scope

Given the extent of FOB personnel resource capability and other priority commitments, the scope of this study had to be restricted. The largest group of reported HEEE interference problems in Fiscal Year 1976 involved television receivers (the affected device) and CB radio transmitters (the affecting device.[8/] Projections indicated this trend would continue.

7/ During Fiscal Year 1976, 83 percent of all reported interference to HEEE was associated with CB radio transmissions.

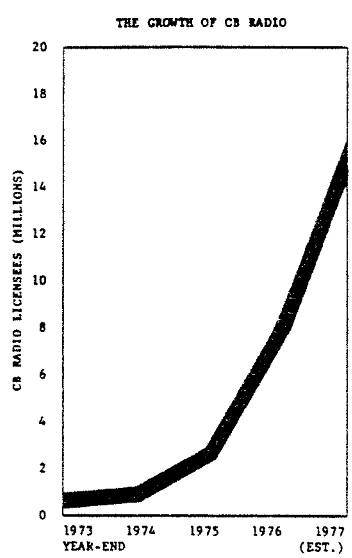
8/ Eighty-seven percent of all reported interference to HEEE involved impaired television reception and 85 percent of all reported interference to television was associated with Citizens Band radio transmissions.

FIGURE 1



*(Transition quarter data excluded)

FIGURE 2



Therefore the scope of this study was restricted to identifying and determining the relative importance of the various factors involved in the CB-TV interference situation. Tests were restricted to CB channels 1 through 23 because these were the only channels authorized when this survey was initiated, and to VHF TV channels 2 through 13 as UHF channels are seldom affected by CB transmissions. Emphasis was placed on testing the receiver, the transmitter, and their interactions in physical and electromagnetic operating environments. Data concerning audio rectification was collected only if the affected device was a television receiver. (Audio rectification is a much more prevalent problem in association with strictly audio devices such as phonographs, intercoms, tape recorders, etc.) This study does attempt to provide reasonably accurate estimates of the total extent of CB-TV interference.

Objectives

FOB plans to use the results of this study to improve its HEEE interference resolution assistance to the public and to station operators. Application of increased understanding of the interrelationship of parameters involved in an HEEE complaint will decrease the inconvenience and cost to all parties involved in a complaint, i.e., FOB, station licensee, HEEE user. This report is also being made available to all elements within the Commission, to CB equipment manufacturers, TV equipment manufacturers and to other interested parties in the hope that this empirical data will provide new information which could aid in establishing and implementing interference protection levels at the point of manufacture.

METHODOLOGY

Approach

Procedures were developed to conduct on-scene analysis of randomly selected general public complaints relating to television reception difficulties associated with CB radio transmissions[9/] at 72 randomly selected complaint locations. Engineers from six Commission district offices made a variety of carefully controlled test measurements and conducted interviews in the complainant's immediate neighborhood.[10/] The basic program proceeded from the premise that little authenticated and correlated data now exists relating to TV-CB complaints. Most information currently available appears to have been collected over the years in limited situations and for a variety of purposes. Often data has been collected during tests of specific transmitters and receivers in the laboratory and, less frequently, "real world" locations of interference problems. The engineers were assigned the task of detecting and quantifying all parameters external to the device which might be associated with or contribute to interference. In turn, this quantitative data was used to develop profiles of the typical receiver and

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9/ See Appendix Y.

10/ See Table 1 on p. 8.

transmitting facilities. These profiles were used for in-depth analysis to seek significant factors which could be exploited in resolving the majority of complaints received.

Several other constraints were considered when outlining the program. First, as the engineers were dealing with on-scene evaluations, the cooperation of both complainant and station operator was needed. In fairness to these parties, every effort was made to limit prolonged and repeated access to the transmitting and receiving equipment which are generally installed in a home. This meant tests and data accumulation must proceed in a predetermined fashion with minimum on-scene time expended in resolving anomalies. Other constraints included the ability of participating offices to devote manpower and travel funds to the program; therefore, complaints were randomly selected from an area within approximately 150 miles of the district office.

No preconceived notions were incorporated in the program; rather, it was assumed that any number of factors could be responsible for the complaint. A technical survey was developed to look at the CB transmitter, television receiver, transmitting and receiving antennas, and specific environment.[11/] A nontechnical survey was developed to obtain estimates of the extent of radio frequency interference experienced by neighbors of the subject.[12/]

11/ See Appendix W.

12/ See Appendix Z.

TABLE 1

DISTRICT OFFICE PARTICIPATION AND TV CHANNEL OUTLINE

FCC District Office	Number of Cases Investigated	VHF TV Channels Normally Viewed 13/
Baltimore 14/	5	2, 4, 5, 7, 8, 9, 11, 13
Buffalo	12	2, 4, 5, 7, 9, 11
Kansas City	16	4, 5, 9
Norfolk	14	3, 6, 8, 10, 12, 13
San Francisco	11	2, 3, 4, 5, 6, 7, 9, 11, 13
Seattle	14	4, 5, 7, 9, 11, 13

13/ UHF television is seldom affected by CB-TV problems and was not considered in this survey.

14/ Baltimore began participation late in the program.

Television Receiving System

The television receiver is essentially a device that transforms received radio frequency signals into a visual picture with accompanying sound. To function in the modern electromagnetic environment, and deliver acceptable quality, it must be able to distinguish and receive the desired channel while simultaneously rejecting all other radio signals. These other signals may be composed of a variety of transmissions such as CB, amateur, standard broadcast, FM broadcast, police, business or television. A complete receiving installation includes not only a receiver, but also a receiving antenna, signal amplifiers, and transmission line (antenna lead-in).

Information concerning each complainant's television receiver was collected by on-site observations and measurements. Basic data was compiled on the physical television receiver, including make, model, approximate age,[15/] display capability (black/white or color) and whether the active elements were essentially solid-state.[16/] Similar data on the receiving antenna system included type antenna, type lead, mounting location, booster amplifier[17/] and filters.

15/ See Appendix T.

16/ See Appendix O.

17/ See Appendix Q.

Important data was collected on the theoretical grade of the TV signals delivered to the community and on the level of the TV[18/] and CB[19/] signals delivered by the reception system to the TV receiver antenna terminals, as well as on the actual TV signal field strength measured at the complainant's residence. Comparison of these values provided an indication of receiving system performance. The quality of TV receiver performance and and degree of interference were numerically estimated by utilizing TASO[20/] ratings for each channel received and viewed. These tests were duplicated with an FCC receiver[21/] for purposes of comparison. These tests were conducted under conditions of normal reception and reception as influenced by CB station operation.

18/ See Appendix K.

19/ See Appendix J.

20/ Engineering Aspects of Television Engineering Report of the Television Allocations Study Organization (TASO) to the Federal Communications Commission, March 16, 1959. Also see Figure 3, p. 12, and Appendix I.

21/ See Appendix X.

CB Station

A Citizens Band radio station is authorized to operate in a narrow segment (26.965 MHz through 27.405 MHz) 22/ of the radio frequency spectrum. All emissions from the transmitter on frequencies or channels other than those assigned must be attenuated to a specified level. 23/ CB channels are harmonically related to VHF TV channels 2, 5, 6, 9 and 13. 22/ The majority of television reception problems attributable to a transmitting system "fault" are manifest on the harmonically related channels. Other television reception problems attributable to a transmitting system "fault" involve spurious signal generation.

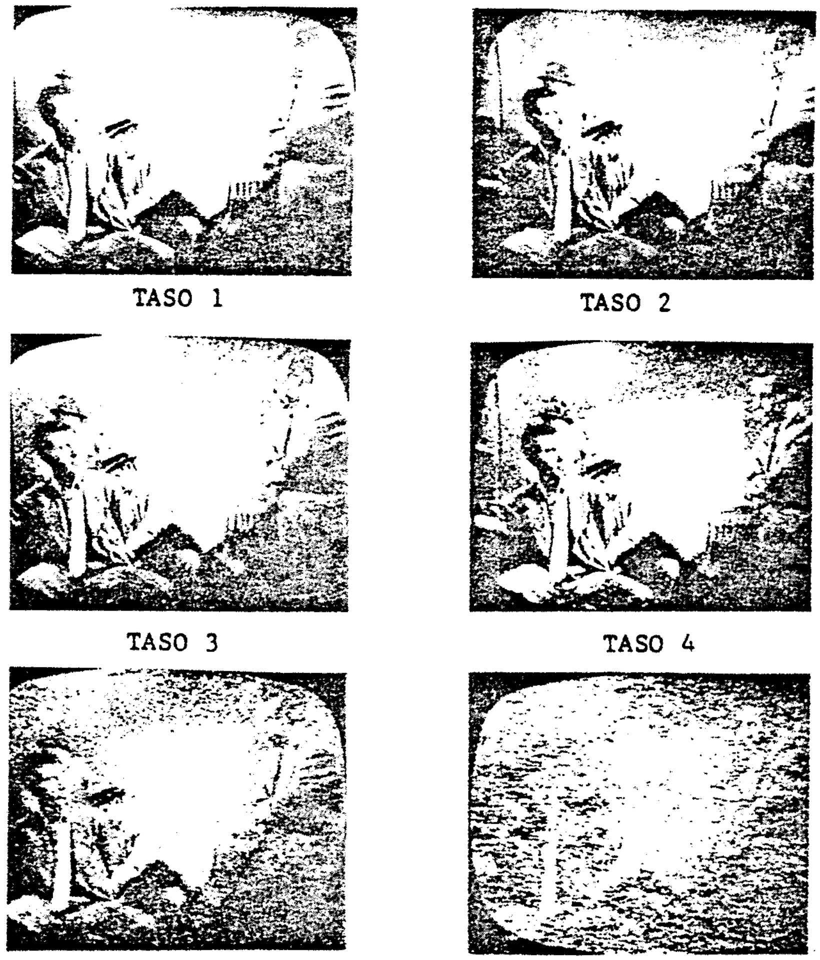
On-scene observations and measurements were made of the transmitting system. Basic data was compiled on the physical CB transmitter, 24/ including make, model, type acceptance number and use of power microphone. 25/ Similar data on the transmitting antenna system included type antenna, gain, mounting location and filters.

22/ Tests conducted during this study utilized CB channels 1 through 23 (26.965 MHz through 27.255 MHz) as these were the only channels authorized at the time this study was initiated.

23/ 47 CFR 95.61. In the Second Report and Order in Docket 20210 adopted July 27, 1976, the Commission increased the harmonic radiation suppression requirement to 60 dB for all new Class D transmitters sold.

24/ See Appendix U.

25/ See Appendix R.



TASO 1 TASO 2

TASO 3 TASO 4

TASO 5 TASO 6

FIGURE 3

Receiver overload (self-induced receiver interference) is related to the level of the CB fundamental signal at the complainant's TV receiver. Transmitter power output, antenna system s.w.r. and calculated ERP were recorded in an effort to correlate the delivered signal with conditions prevailing at the CB transmitter. Levels of CB harmonic and spurious signals delivered at the complainant's TV receiver can also be correlated with degree of interference. By utilizing the TASO ratings as previously outlined, the various levels of CB signals were correlated with the degree of TV interference.

Physical and Electromagnetic Environment

Observations were made of many physical and electromagnetic environmental conditions that could possibly affect the TV-CB complaint. Data was compiled on vertical distance between the complainant's and the subject's antenna, horizontal distance between the complainant's and the subject's residences,[26/] type of home construction in the area, type of area zoning and density of residences in the area. Also, all regularly viewed VHF TV channels were listed, as well as the predicted grade of those signals over the community. The degree of correlation between HEEE interference and several of these factors was pursued with some success.

26/ See Appendix H.

Power Amplifier Determination

A very controversial issue has been the impact of external radio frequency power amplifiers (linears)[27/] on HEEE interference complaints. Therefore, a major effort was made to obtain accurate data relating to the use of linears. The percentage of complaints generated by stations utilizing linear amplifiers was determined by quantifying radiated power levels through relative field strength measurements made during unannounced pre-inspection monitoring. Each station was monitored for twenty hours or until active. Also, during the inspection the involved parties were extensively questioned for any indication of the use of a linear amplifier. To assure a free exchange of information, the CB station operator was assured no sanction action would be imposed as a result of this survey. Where an operational linear amplifier was found, it was tested in the same manner as the CB transmitter as described above under "CB Station."

Extent of Television Interference (TVI)

A comprehensive solution to HEEE complaints should include consideration of the total number of individuals actually experiencing television interference when a CB station is operated in the neighborhood. The Commission knows how many formal complaints are filed but no data has been available, previous to this study, with which to project this number of known complaints to estimate the actual number of individuals receiving interference but not complaining to the FCC.

27/ See Appendix F.

At each complaint location to be evaluated, a number of the complainant's neighbors within a given geographical area were randomly selected and interviewed.[28/] The interview questions were designed to identify type of interference, device affected, severity, duration, frequency of occurrence, TV viewing habits, interference source, action taken, and physical separation. Care was taken to avoid influencing responses of the individual being interviewed. This data was then summarized by computer and the average TVI complaint information was used to form a nationwide estimate of the extent of TVI (see Appendices B and AB).

28/ See Appendix Z.

FINDINGS AND CONCLUSIONS

MILLIONS OF VIEWERS EXPERIENCE NOTICEABLE CB-TV INTERFERENCE

Over 500 dwellings situated in 72 distinct neighborhoods in six metropolitan areas were surveyed. If these areas are representative of the nation as a whole, it is estimated that in Fiscal Year 1976, a lower bound for the nationwide extent of television interference associated with CB radio station transmissions would be between one and ten million individuals, with the best estimate being 4,000,000 individuals (1.3 million households). All of this CB-TV interference was attributable to the operation of approximately 22,000 CB stations. Although it is difficult to determine the effects of the introduction of the additional 17 CB channels and the increased harmonic attenuation requirements, the following estimates based on historical data would indicate that the extent of the CB-TV interference problem is increasing:

Fiscal Year	CB-TVI Complaints	CB Operators Causing TVI	Individuals Receiving TVI
1976	45,210	22,000 (18,000-32,000)	4 million (1-10 million)
1977	60,000 (54,000-66,000)	29,000 (16,000-60,000)	5 million (2-12 million)
1978	90,000 (81,000-99,000)	44,000 (27,000-80,000)	8 million (3-16 million)
1979	105,000 (94,500-115,500)	50,000 (29,000-100,000)	9 million (3-21 million)

Further information regarding this matter may be found in Appendix B.

NUMBER ONE CAUSE OF INTERFERENCE IS INADEQUATE SUPPRESSION OF HARMONIC AND SPURIOUS RADIATION AND CURRENT PROTECTION LEVELS ARE INADEQUATE

Antenna line harmonic [29/] radiation levels from the CB transmitting equipment were, in general, marginally suppressed or not suppressed to FCC standards existing at the time of the test. Observed values are contained in Appendix C. A low-pass filter, when inserted, substantially increased the suppression, usually to meet and exceed FCC requirements and eliminate the interference. In general, a linear amplifier's harmonic suppression was approximately 10 dB poorer than the tested group of CB transmitters.

Present requirements for harmonic suppression are inadequate as it was found that even antenna line harmonic radiation suppressed more than 60 dB (specified value for new transmitters) was still a basic cause of TV interference complaints.

Precise data for transmitter chassis radiation could not be obtained because a proper measurement procedure was not available for tests in the field. However, the effect of this source of interference was visible in a number of the cases. Further reduction of transmitter chassis radiation will be required to resolve many complaints. See Appendix D for a discussion of chassis radiation.

29/ This refers to signals emanating from the CB transmitter at the transmitter's rf antenna output connector and not chassis radiation.

Either antenna line or chassis harmonic radiation was the primary or partial cause of television interference in 55 percent of the cases.

RECEIVER OVERLOAD SERIOUS BUT USUALLY CORRECTED BY FILTER

TV receiver overload was the primary or partial cause of 45 percent of the TV interference complaints investigated. However, this percentage varied widely between test communities depending upon whether TV channels harmonically related to CB frequencies were viewed. The actual percentage of cases attributable to receiver overload varied with area from 25 to nearly 100 percent.

A high-pass filter installed in simple fashion at the TV antenna input terminals was effective in resolving or improving approximately 80 percent of receiver overload interference. Such an installation would be within the capability of most adult TV viewers.

A fundamental (27 MHz) CB signal level of approximately 76 dBuV[30/] across 300 ohms at the TV antenna terminals was required before receiver overload became a factor. Note that this value does not address factors such as low TV signal level. A further discussion of this matter is presented in Appendix E. Greater unwanted signal rejection capability incorporated at the point of TV receiver manufacture would eliminate at least one-third of all cases of CB-TV interference.

30/ dBuV = decibels above one microvolt.

LINEARS ARE A MAJOR CONTRIBUTOR TO TVI

Linear rf power amplifier use was associated with 46 percent of all TV-CB interference cases. Over half of the cases involving a linear were resolved by eliminating the linear and in the remaining cases, the interference was substantially reduced by removing the linear. See Appendix F for additional information.

FILTERS EXTREMELY EFFECTIVE BUT LITTLE USED

The following tables on pages 20 and 21 illustrate the effectiveness of the low-pass and high-pass filter when applied to TV interference cases in general. Of course, the low-pass filter was designed to eliminate transmitter harmonics and the high-pass filter was designed to eliminate receiver overload and each can only be expected to perform when the appropriate type of interference is present. These tables also exhibit a certain bias because of the manner in which the tests were conducted. A low-pass filter was placed in the CB transmission line and a series of tests made. Then, with the low-pass filter still installed at the CB, the high-pass filter was inserted at the TV antenna terminals and additional tests made.

In the surveyed cases, eight percent of the complainants used a high-pass filter and 43 percent of the CB stations used a low-pass filter. Related information is contained in Appendix C and Appendix E.

EFFECTS OF LOW-PASS (LP) AND HIGH-PASS (HP) FILTERS

Interference on TV Channel 2

(Second Harmonic Problems)

	LP Filter at CB		Additional Complaints Resolved with HP Filter at TV		HP Filter at TV and LP Filter at CB	
Resolved	7	35%	4	31%	11	55%
Improved	6	30%	1	8%	4	20%
No Effect	7	35%	8	62%	5	25%
Degraded	-		-		-	
Improved and Degraded 31/	-		-		-	

Interference on TV Channel 5

(Third Harmonic Problems)

	LP Filter at CB		Additional Complaints Resolved with HP Filter at TV		HP Filter at TV and LP Filter at CB	
Resolved	6	18%	4	15%	10	30%
Improved	11	32%	7	26%	11	33%
No Effect	15	44%	12	44%	6	18%
Degraded	2	6%	4	15%	3	9%
Improved and Degraded	-		-		3	9%

31/ TV picture degraded at least one TASO grade on one channel and improved at least one TASO grade on one channel. Note that one filter may cause the improvement and the other filter cause the degradation.

Interference on any TV Channel 32/

(Harmonic and Nonharmonic Problems)

	LP Filter at CB		Additional Complaints Resolved with HP Filter at TV		HP Filter at TV and LP Filter at CB	
Resolved	13	25%	10	25%	23	43%
Improved	18	34%	10	25%	15	28%
No Effect	18	34%	14	35%	7	13%
Degraded	2	4%	5	13%	2	4%
Improved and Degraded	2	4%	1	3%	6	11%

Interference on TV Channels 3, 10 or 13

(Nonharmonic Problems)

(Only 3, 10 & 13 viewed in community)

	LP Filter at CB		Additional Complaints Resolved with HP Filter at TV		HP Filter at TV and LP Filter at CB	
Resolved	5	36%	6	67%	11	79%
Improved	-		-		-	
No Effect	9	64%	3	33%	3	21%
Degraded	-		-		-	
Improved and Degraded	-		-		-	

32/ These values are dependent on what TV channels are viewed. This table assumes that 80 percent of the complainants regularly view a TV channel harmonically related to a CB frequency.

TV CHANNELS 2 AND 5 RECEIVE BRUNT OF INTERFERENCE

In Appendix G there is a graph illustrating the probability of TV-CB interference as a function of TV channel viewed. There was a much higher probability of receiving interference on TV channels 2, 5 and to a lesser extent 9 (all CB harmonically related) than on the other TV channels.[33/] Also, on these TV channels, most of the interference was CB transmitter related.

INTERFERENCE SIGNIFICANTLY DEGRADES TV PICTURE QUALITY

Television interference for the purposes of this report was arbitrarily defined as TV reception degraded by CB transmissions to a level at least one TASO grade below normal reception quality. To understand the severity and validity of an individual's TV-CB complaint all TV pictures were rated for quality. Without interference active, the complainants received an acceptable picture (TASO 3 or above) on 80 percent of the viewed TV channels. An FCC receiver substituted for the complainant's receiver performed somewhat better by increasing the value to 90 percent. Thus, defective[34/] TV receivers were not a major contributor to CB-TV interference problems.

33/ Since this survey was restricted to 23-channel CB sets, TV channel 6 was not harmonically related. With widespread future use of 40-channel CB sets, channel 6 (television) can be expected to receive a much higher proportion of interference.

34/ As used here, defective refers to some obvious defect not related to CB operation such as very poor sensitivity.

In general, when interference occurred on a TV channel of the complainant's receiver the picture quality was degraded to an unacceptable level (TASO 4 or below) in approximately 70 percent of the cases and on the FCC receiver in approximately 30 percent of the cases. When experienced, receiver overload was the most severe type of interference. It resulted in unacceptable reception on approximately 75 percent of the affected channels. However, overload was normally experienced only on the complainant's receiver. Interference attributed to spurious or harmonic radiation from the CB transmitting equipment caused approximately 60 percent of the affected TV channels to be rated unacceptable. As expected, the same interference held for the FCC TV receiver. Thus, the complainants had valid complaints. Further comments on picture quality are contained in Appendix I.

COMPLAINANTS PREDOMINANTLY RESIDE IN GRADE A AND B TV SERVICE AREAS

The complainants were located predominantly in Grade A and Grade B TV service contour areas, possibly due to the 150-mile travel constraints placed upon the case selection procedures. Actual measured values, off the air and off the complainant's antenna, found approximately 80 percent of the received channels of signal level sufficient to provide adequate picture quality. Refer to Appendix K for a detailed discussion.

LINEARS AND HIGH-GAIN ANTENNAS SIGNIFICANTLY INCREASE THE GEOGRAPHICAL AREA EXPERIENCING INTERFERENCE

If a CB station consisted of a nondirectional (low-gain) antenna and a 4-watt transmitter, 60 percent of the complainants were located within 50 feet of the subject and 95 percent were within 200 feet. Where a high-gain directional antenna or linear amplifier was used, the affected area was increased. The high-gain directional antenna appears to have substantially the same affected area increase as the linear amplifier. Greater controls on effective radiated power could eliminate approximately 50 percent of all interference complaints. Actual variations are illustrated in Appendix L and Appendix H.

ERP MUCH GREATER THAN FOUR WATTS

Transmitters - average output power 3.6 watts (with a range of 1.1-13 watts)

Linears - average output power 117 watts (with a range of 25-400 watts)

Antennas - average gain 6.1 dB [35/]

Antennas at stations using a linear - average gain 7.8 dB

Antennas at stations not using a linear - average gain 4.5 dB

ERP of stations without linears - average 10 watts

ERP of stations with linears - average 700 watts

35/ Calculated utilizing manufacturer's specifications.

High-gain directional antennas were concentrated with those stations utilizing a linear amplifier. Fifty-two percent of the stations using a linear also used a high-gain antenna while only 36 percent of the stations not using a linear used a high-gain antenna.

ON-SITE ENFORCEMENT MONITORING IS TIME-CONSUMING

After at least 20 hours of unannounced monitoring were devoted to each CB station associated with a TV interference complaint, 72 percent of the stations were observed in operation Approximately 70 percent of the stations observed operating were involved in an infraction of some FCC regulation such as failure to observe operating time limits. Although inspection verified that 46 percent of the stations had on occasion used a linear amplifier, only 18 percent of the total 72 case samples were observed using a linear amplifier during unannounced monitoring. Using these figures, it is estimated that 430 manyears of unannounced monitoring would be required to detect 50 percent of the linear amplifiers in use and associated with a CB-TV interference complaint. This figure excludes travel and administrative time. Further discussion is contained in Appendix M.

POWER MIKES DO NOT CONTRIBUTE TO TVI

Power mikes often caused excessive modulation and an increase in spurious and harmonic levels. However, power mike use did not affect any observed TV interference.[36/] Further discussion is contained in Appendix R.

CB CHANNEL OF OPERATION INFLUENCES SOME INTERFERENCE PROBLEMS

Interference on TV channel 2 and 5 was reduced by operating on the low and high ends, respectively, of the CB band. Nearly 50 percent of the observed interference on TV channel 2 was eliminated by operating on the low CB channels (1-7) while approximately 30 percent of the TV channel 5 video interference was eliminated by operating on the high CB channels (17-23). See Appendix S for additional discussion.

As indicated in the above findings and conclusions, CB-TV interference is a very complex problem. No single approach appears capable of resolving all complaints. Rather, coordinated action will be required of CB operators, TV viewers, CB manufacturers, TV manufacturers, and the Commission.

This study has generated a large quantity of "raw data" that will be of interest to the technical reader. For this reason, many detailed appendix items have been included. Hopefully, this material will facilitate action by concerned parties.

36/ Interference to other CB operation would be expected.

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APPENDIX A

CASE SYNOPSES

Case 2-2026 - Slight interference only on channel 2 caused by harmonic antenna radiation from the CB transmitter. The interference was resolved by installation of a low-pass filter. The CB transmitter harmonic suppression was not sufficient to prevent the interference.

Case 3-2026 - The CB transmitter tests found no TV interference active; however, preinspection monitoring revealed use of a linear amplifier. The subject would not produce the linear amplifier for testing. The complaint was attributed to use of linear amplifier with specific causes undetermined.

Case 5-2026 - The CB transmitter tests revealed no TV interference present; however, the licensee indicated that in the past he had used a linear amplifier. The linear was not available for testing. A broadband receiving booster was used in the TV receiving system. The complaint was attributed to use of a linear amplifier with specific causes undetermined.

Case 6-2026 - With only the CB transmitter operating, interference was observed on channel 5 on both FCC's and complainant's receiver. The interference was caused by harmonic antenna radiation from the CB transmitter. Subject also had a linear amplifier of 87 watts output. With the linear active, interference was prevalent on channels 4, 5 and 9. No interference on channels 7, 11 and 13. The interference with linear active was caused by harmonic antenna and chassis radiation from the transmitter-linear combination. An inadequate TV receiving antenna probably contributed to the problem.

Case 4-2176 - The CB transmitter tests revealed no TV interference present; however, licensee indicated that in the past he had used a linear amplifier. The linear was not available for testing. The complaint was attributed to use of a linear with specific causes undetermined.

Case 6-2176 - With only the CB transmitter operating, slight color interference was observed on channel 5 which was caused by harmonic antenna radiation from the CB transmitter. A low-pass filter resolved the problem. The subject also had a 300-watt output linear amplifier that was observed in operation but tests were not conducted using the linear as it was sold immediately prior to the tests. The complaint was attributed principally to use of a linear amplifier with specific causes undetermined.

Case 2-2316 - Interference was observed on harmonically related TV channels 2 and 5. The interference was caused by harmonic antenna and chassis radiation from the CB transmitter. A low-pass filter eliminated part of the radiation leaving only chassis radiation to be resolved. The CB transmitter harmonic suppression was not sufficient to prevent interference. An inadequate TV receiving antenna probably contributed to the problem.

Case 3-2316 - The subject was using a 70-watt output linear amplifier that produced slight interference on the complainant's TV receiver only on channel 5. The interference was caused by receiver overload and was corrected by installation of a hang-on high-pass filter on the complainant's TV receiver. No interference was experienced on the FCC receiver. No tests were made without the linear.

Case 4-2316 - Interference was observed on the complainant's TV receiver on all channels. No interference was observed on the FCC receiver. Installation of a low-pass filter (with small accompanying insertion loss) corrected most interference on the complainant's receiver. The interference problem was due to fundamental receiver overload.

Case 5-2316 - With only the CB transmitter operating, slight interference was observed on channel 2. The interference was caused by harmonic antenna radiation from the CB transmitter. Installation of a low-pass filter resolved the problem. Also, the subject had a linear amplifier that was not tested because it was inoperative at the time of investigation. The complaint was attributed principally to the use of a linear amplifier with specific causes undetermined.

Case 6-2316 - Mild interference was observed only on channel 5. The interference was classified as an externally generated harmonic and was observed on both the FCC and the complainant's receiver. Prior to investigation, the CB station antenna was replaced which reportedly resolved many earlier problems.

Case 2-2466 - With the CB transmitter operating, interference was observed on harmonically related TV channels on the FCC and the complainant's receivers. A low-pass filter resolved the interference. The interference was caused by harmonic antenna radiation from the CB transmitter. The subject also had a 60-watt output linear amplifier which, when operated, exaggerated the interference and again only on harmonically related TV channels. The interference was caused by harmonic antenna radiation from the CB linear and transmitter.

Case 3-2466 - With the CB transmitter operating, interference was observed on the harmonically related TV channels. The interference was caused by harmonic antenna and chassis radiation from the CB transmitter. Installation of a low-pass filter partially resolved the problem. The CB transmitter harmonic suppression was not adequate to prevent interference. Also, the subject admitted to having used a linear amplifier but the linear was not available for testing.

Case 5-2466 - Interference was observed only on TV channel 2 on both the FCC and the complainant's receivers. The interference was caused by harmonic antenna radiation from the CB transmitter and the problem was corrected by installation of a low-pass filter. An inadequate TV receiving antenna contributed to the problem.

Case 6-2466 - The interference was on harmonically related channels 5 and 9 on both the FCC and the complainant's receivers. The interference was caused by a combination of harmonic chassis radiation and antenna radiation from the CB transmitter and an externally generated harmonic.

Case 3-2606 - The subject was using a 25-watt output linear amplifier and interference was observed on all received channels 4, 5 and 9. Installation of a low-pass filter resolved the problem. The interference was caused by harmonic/spurious antenna radiation from the linear amplifier. No tests were made without the linear.

Case 4-2606 - The subject was using a 400-watt output linear amplifier. The complainant's receiver experienced interference on all channels received, while the FCC receiver experienced no interference. A hang-on high-pass filter did not resolve the problem. The interference was caused by receiver overload. No tests were made without the linear.

Case 2-2756 - With the CB transmitter operating, interference was observed only on harmonically related TV channels 2, 5 and 9. The interference was caused by chassis radiation from the CB transmitter. Harmonic chassis radiation suppression was not adequate to prevent interference.

Case 3-2756 - Tests showed no interference on any channel. The subject indicated that he had used a linear amplifier in the past but recently disposed of it. The complaint was attributed to use of a linear amplifier with specific causes undetermined.

Case 4-2756 - The subject was using a 250-watt output linear amplifier. Interference was observed on the complainant's receiver on all TV channels and no interference observed on the FCC receiver. Installation of a hang-on high-pass filter eliminated the problem. The interference was caused by receiver overload. No tests were made without the linear.

Case 5-2756 - Tests of the subject's transmitter revealed no interference to TV reception. However, the subject recently installed a new transceiver that reportedly corrected the problem. The complaint was attributed to spurious and harmonic radiation from the previous transmitter.

Case 3-2896 - With the CB transmitter operating, interference was observed on TV channel 5 on both the FCC and the complainant's receivers. The interference was caused by chassis radiation from the CB transmitter and complicated by a low signal level from the TV station. Also, the subject indicated that in the past a linear amplifier was used.

Case 4-2896 - The subject was using a 250-watt output linear amplifier. Interference was experienced on the complainant's TV receiver on channel 3. No interference was observed on the FCC receiver. Installation of a low-pass filter (with small accompanying insertion loss) eliminated the interference. The problem was caused by receiver overload. No tests were made without the linear.

Case 6-2896 - With the CB transmitter operating, interference was observed on channel 5 and was experienced on both the FCC and the complainant's receivers. A low-pass filter partially resolved the interference. The cause of the problem was externally generated harmonic radiation and transmitter harmonic antenna radiation. The problem was probably aggravated by a weak channel 5 TV signal.

Case 3-3066 - The subject was using a 50-watt output linear amplifier. With the linear in use interference was experienced on TV channel 5 on both the FCC and the complainant's receivers. Installation of a low-pass filter resolved the problem. The problem was caused by harmonic antenna radiation from the transmitter-linear combination. No tests were made without the linear.

Case 4-3066 - The subject was using a 200-watt output linear amplifier which caused interference to the complainant's TV receiver on channels 6 and 8. There was no interference on TV channel 12 or on the FCC receiver. Installation of a low-pass filter (with small accompanying insertion loss) eliminated the interference. The problem was caused by receiver overload. No tests were made without the linear.

Case 6-3066 - With the CB transmitter operating, interference was observed on TV channel 5. The problem was resolved by installation of a low-pass filter on the subject's transmitter. The complaint was attributed to inadequate suppression of the transmitter antenna harmonic radiation. Also, an extremely inadequate TV receiving antenna probably contributed to the problem.

Case 3-3206 - With the CB transmitter operating, interference was observed only on TV channel 2. The problem was resolved by installation of a low-pass filter on the subject's transmitter. The interference was caused by harmonic antenna radiation from the CB transmitter. As a further note, it is suspected that the subject had in the past used a linear amplifier but it was not available for testing.

Case 6-3206 - With the CB transmitter operating, interference was observed on various TV channels on both FCC and the complainant's receivers. The problem was caused by spurious/harmonic chassis radiation from the CB transmitter. Also, the problem was probably aggravated by weak television signals.

Case 3-3366 - With only the CB transmitter operating, no interference was observed. When using a 50-watt output linear amplifier interference was observed only on TV channels 4 and 5. The problem was resolved by installing a low-pass filter. The interference was caused by harmonic/spurious antenna radiation from the linear amplifier.

Case 1-3506 - With the CB transmitter operating, interference was observed on harmonically related TV channels 5 and 9. The interference was caused by chassis radiation from the CB transmitter. Harmonic chassis radiation suppression was not adequate to prevent interference. The problem was probably aggravated by weak channel 5 and 9 TV signals.

Case 1-3366 - With the CB transmitter operating, no visual TV interference was observed. However, there was audio interference on channel 5 on the complainant's TV receiver. No interference was observed on the FCC receiver. The audio problem was attributed to receiver overload. A hang-on high-pass filter did not resolve the interference.

Case 2-2606 - With the CB transmitter operating, interference was observed on TV channels 2 and 5. The interference was caused by a combination of harmonic antenna radiation and receiver overload. A low-pass and hang-on high-pass filters resolved the problem. The complainant's TV also experienced audio rectification on all channels.

Case 3-0037 - With the CB transmitter operating, interference was observed on TV channels 4 and 5 on the complainant's receiver. No interference was observed on the FCC receiver. A hang-on high-pass filter partially resolved the problem. The interference was caused by receiver overload. The subject admitted that in the past he had used a linear amplifier but it was not available for tests.

Case 3-3506 - The CB transmitter tests revealed no TV interference present. However, the available evidence indicated that at times the subject was operating a linear amplifier but it was not available for tests. The complaint was attributed to use of a linear amplifier with specific causes undetermined.

Case 4-2466 - The subject was using a 100-watt output linear amplifier. The complainant's receiver experienced interference on all TV channels received. No interference was experienced on the FCC receiver. A hang-on high-pass filter did not resolve the problem. However, it was resolved by installing a proper impedance antenna line. A broadband receiving booster amplifier was used in the TV receiving system. The interference was caused by receiver overload. No tests were made without the linear.

Case 4-0177 - With the CB transmitter operating, interference was observed on TV channel 3 on the complainant's receiver. No interference was observed on the FCC receiver. A hang-on high-pass filter resolved the problem. The interference was caused by receiver overload.

Case 4-3206 - With the CB transmitter operating, interference was observed on TV channel 3 on the complainant's receiver. No interference was observed on the FCC receiver. A hang-on high-pass filter resolved the problem. The interference was caused by receiver overload.

Case 4-3366 - With the CB transmitter operating, interference was observed on all channels on the complainant's receiver. No interference was observed on the FCC receiver. A hang-on high-pass filter did not resolve the problem. However, it was resolved by disconnecting an internal TV antenna. The interference was caused by receiver overload.

Case 5-0037 - With the CB transmitter operating, interference was observed on harmonically related TV channels 2, 5 and 9. The interference was partially resolved by installation of a low-pass filter. The CB transmitter harmonic suppression was not sufficient to prevent interference. Also, the subject admitted that he had used a linear amplifier in the past but it was not available for tests.

Case 5-0177 - With the CB transmitter operating, interference was observed on TV channels 2, 4 and 5 on the complainant's receiver. No interference was observed on the FCC receiver. A hang-on high-pass filter resolved the problem. The interference was caused by receiver overload.

Case 5-0327 - With the CB transmitter operating, no visual TV interference was observed. However, there was audio rectification on all channels on the complainant's TV receiver. A hang-on high-pass filter did not resolve the interference. A broadband receiving booster amplifier was used in the TV receiving system.

Case 5-3206 - The subject was using a 50-watt output linear amplifier. Interference was observed on the complainant's receiver on TV channel 5. The interference was caused by chassis radiation from the linear amplifier. No tests were made without the linear.

Case 5-3366 - With the CB transmitter operating, interference was observed on TV channels 2 and 5. A hang-on high-pass filter partially resolved the interference. The problem was attributed to receiver overload and transmitter harmonic chassis radiation. The interference was probably aggravated by weak channel 2 and 5 TV signals.

Case 6-0177 - With the CB transmitter operating, no visual TV interference was observed. However, there was audio interference on channel 5 on the complainant's TV receiver. No interference was observed on the FCC receiver. The audio problem was attributed to receiver overload. A hang-on high-pass filter did not resolve the interference.

Case 6-3506 - The subject was using a 40-watt output linear amplifier. No interference was observed on the complainant's or FCC TV receivers. There were indications that the subject may have used in the past a higher power linear that was responsible for the interference complaint. No tests were made without the linear.

Case 2-3206 - With the CB transmitter operating, interference was observed on all TV channels received. A broadband receiving booster amplifier was used in the TV receiving system. The interference was attributed to fundamental overload of the receiving booster amplifier.

Case 1-0037 - With the CB transmitter operating, no visual TV interference was observed. However, there was audio interference on channel 2 on the complainant's TV receiver. No interference was observed on the FCC receiver. The audio problem was attributed to receiver overload. A hang-on high-pass filter resolved the interference.

Case 2-0037 - With the CB transmitter operating, interference was observed on harmonically related TV channels 2, 5 and 9. The interference was caused by chassis radiation from the CB transmitter. Harmonic chassis radiation suppression was not adequate to prevent interference. An inadequate TV receiving antenna probably contributed to the problem.

Case 4-0037 - With the CB transmitter operating, interference was observed on the complainant's TV receiver on all channels. No interference was observed on the FCC receiver. A hang-on high-pass filter resolved the problem. The interference was caused by fundamental receiver overload.

Case 1-0177 - The CB transmitter tests revealed no TV interference present; however, evidence indicated that in the past the subject had used a linear amplifier. The linear was not available for testing. The complaint was attributed to use of a linear with specific causes undetermined.

Case 2-0177 - With the CB transmitter operating, interference was observed on TV channels 2, 4 and 9. The interference was attributed to a combination of harmonic antenna radiation from the transmitter and an externally generated harmonic. A low-pass filter eliminated part of the problem. Also, evidence indicated that in the past the subject had used a linear amplifier. The linear was not available for testing.

Case 3-0177 - With the CB transmitter operating, interference was observed on TV channels 5 and 9. The interference was attributed to harmonic antenna radiation. A low-pass filter resolved the problem. The CB transmitter harmonic antenna radiation suppression was not sufficient to prevent interference. Also, a linear amplifier was observed in operation but the linear was not tested.

Case 2-0327 - Interference was observed on harmonically related TV channels 2, 5 and 9. The interference was caused by harmonic antenna and chassis radiation from the CB transmitter. A low-pass filter eliminated part of the radiation leaving only chassis radiation to be resolved. The CB transmitter harmonic suppression was not sufficient to prevent interference. An inadequate TV receiving antenna probably contributed to the problem.

Case 3-0327 - With the CB transmitter operating, interference was observed on all TV channels on the complainant's receiver. No interference was observed on the FCC receiver. A hang-on high-pass filter did not resolve the problem. The interference was caused by receiver overload.

Case 4-0327 - With the CB transmitter operating, interference was observed on all TV channels on the complainant's receiver. No interference was observed on the FCC receiver. A hang-on high-pass filter resolved the problem. The interference was caused by receiver overload. A broadband receiving booster amplifier was used in the TV receiving system.

Case 6-0327 - The CB transmitter tests revealed no TV interference. A linear amplifier was not suspect. The complaint was attributed to failure of the complainant to adequately fine tune the TV receiver.

Case 3-0467 - With the CB transmitter operating, interference was observed on TV channel 5 on the complainant's receiver. No interference was observed on the FCC receiver. A hang-on high-pass filter resolved the problem. The interference was caused by receiver overload.

Case 4-0467 - With the CB transmitter operating, no visual TV interference was observed. However, there was audio rectification on all channels on the complainant's TV receiver. A hang-on high-pass filter resolved the interference. A broadband receiving booster amplifier was used in the TV receiving system.

Case 6-0467 - With the CB transmitter operating, interference was observed on TV channel 5 on both the FCC and the complainant's receivers. The problem was attributed to externally generated harmonic radiation.

Case 3-0627 - The CB transmitter tests revealed no TV interference present; however, evidence indicated that in the past the subject had used a linear amplifier. The linear was not available for testing. The complaint was attributed to use of a linear with specific causes undetermined.

Case 4-0627 - With the CB transmitter operating, interference was observed on the complainant's TV receiver on all channels. No interference was observed on the FCC receiver. A hang-on high-pass filter resolved the problem. The interference was caused by fundamental receiver overload.

Case 6-0627 - With the CB transmitter operating, interference was observed on the complainant's TV receiver on all channels. No interference was observed on the FCC receiver. A hang-on high-pass filter partially resolved the problem. The interference was caused by fundamental receiver overload.

Case 6-0767 - With only the CB transmitter operating, no TV interference was observed. However, the subject had a 100-watt output linear amplifier that caused interference on TV channel 5. A low-pass filter resolved the problem. The interference was attributed to inadequate harmonic antenna radiation suppression by the linear. An inadequate TV receiving antenna probably contributed to the problem.

Case 5-0917 - With the CB transmitter operating, interference was observed on TV channels 2 and 5. The problem was partially resolved with a low-pass filter and a hang-on high-pass filter. The interference was attributed to harmonic antenna radiation from the transmitter and fundamental overload of the TV receiver.

Case 2-1087 - With the CB transmitter operating, interference was observed on TV channels 2 and 5 on the complainant's receiver. No interference was observed on the FCC receiver. A hang-on high-pass filter partially resolved the problem. The interference was caused by receiver overload.

Case 6-1087 - With only the CB transmitter operating, no TV interference was observed. However, the subject had an 80-watt output linear amplifier which caused no visual TV interference but did cause audio rectification on all channels on the complainant's TV. No interference was observed on the FCC TV receiver. A hang-on high-pass filter did not resolve the problem.

Case 1-0327 - With the CB transmitter operating, interference was observed only on harmonically related TV channel 5. The interference was caused by chassis radiation from the CB transmitter. Harmonic chassis radiation suppression was not adequate to prevent the interference. An inadequate TV receiving antenna probably contributed to the problem.

Case 5-1237 - With only the CB transmitter operating, interference was observed on all TV channels. The interference was attributed to a combination of harmonic antenna radiation, harmonic chassis radiation and fundamental receiver overload.

Case 3-0767 - With only the CB transmitter operating, no TV interference was observed. However, the subject had a 175-watt output linear amplifier that caused interference on TV channels 4, 5 and 9. The interference was partially resolved with a low-pass filter. The problem was attributed to a combination of harmonic antenna radiation, harmonic chassis radiation and fundamental receiver overload.

Case 2-0627 - Interference was observed on harmonically related TV channels 2, 5 and 9. The interference was caused by harmonic antenna and chassis radiation from the CB transmitter. A low-pass filter eliminated part of the radiation leaving only chassis radiation to be resolved. The CB transmitter harmonic suppression was not sufficient to prevent the interference.

Case 2-0467 - With the CB transmitter (a 90-watt amateur radio unit) operating, interference was observed on TV channel 2 on the complainant's receiver. The interference was caused by a combination of harmonic antenna radiation and receiver overload. A low-pass filter and hang-on high-pass filter partially resolved the problem. Also, the subject had a 90-watt output linear amplifier but it was not tested.

APPENDIX B

SUMMARY OF NEIGHBORHOOD SURVEY DATA

General Statistics

Investigation of the 72 cases in the Radio Frequency Interference (RFI) Neighborhood Survey resulted in 563 interviews. In nearly 50 percent of these interviews, the respondents[1/] indicated that they were receiving TVI. Furthermore, approximately 30 percent of those persons receiving TVI were able to identify the subject (by name or FCC call sign) as the source of the interference. Only 12 percent of those persons receiving TVI had complained, as compared to 33 percent of those who could also identify the subject as the source. On the other hand, approximately 87 percent of those with TVI who had complained could identify the subject as the source of the interference. Finally, of those who had TVI but did not complain and also gave a specific reason for not complaining, about 33 percent stated either that they didn't know they had a problem that might be resolved by complaining, or that they didn't know where to complain.

A series of tests was run in an attempt to examine possible relationships between the presence (or absence) of TVI and various other factors from the Neighborhood Survey. A significant

1/ Respondents in the Neighborhood Survey consisted of eight neighbors of each of the 72 subjects, randomly selected and interviewed.

relationship was found between presence of TVI and the area in which the interviews were conducted. The results of this test were as follows:

Office	Percentage of Respondents with TVI
Norfolk	36%
Baltimore	41%
Seattle	43%
Buffalo	52%
Kansas City	53%
San Francisco	55%
Overall	47%

Reasons for these differences were not found in the time available. Significant differences were also found among the percentages of respondents with TVI in the four "donut-shaped" areas in the neighborhoods (see Table B1). The percentage of respondents with TVI decreased noticeably with distance from the subject. This would seem to indicate, among other things, that in each of the 72 surveyed neighborhoods, the subject was by far the main source of the TVI, due in part to the fact that radio signal levels at a given point are inversely proportional to the distance from the source. Tests were also made to determine whether any significant relationship existed between the occurrence of TVI and various factors concerning the respondent's television receiver. The make, age, display capability (i.e., black and white/ color); and cabinet type (metal/nonmetal) and whether the active elements were essentially solid-state were all tested for relationship with the occurrence of TVI. However, only the solid-state category was found to have an effect (at the .10-level) on the likelihood of TVI, with solid-state receivers demonstrating the greater likelihood of interference. A complete discussion of these tests is contained in Appendix AB.

A summary of all 563 interviews comprising the Neighborhood Survey is found on pages B9 and B10.

Extent of TVI in the Seventy-two Neighborhoods

Estimates of the extent of TVI in the 72 neighborhoods are contained in Table B1. Notice that approximately equal numbers of dwellings were sampled in each of the four "donut-shaped" regions about the subject. Overall, it was estimated that 64 dwellings in each of the 72 surveyed neighborhoods experienced TVI, and that in six of these dwellings the subject could be identified. The calculated (see Appendix AB) 95-percent confidence intervals for these estimates were 49 to 80 and 4 to 7, respectively. Note that there is a fairly wide range to these estimates, and also that these confidence intervals are reflected in the overall estimate of the number of individuals experiencing CB-related television interference.

TABLE B1

ESTIMATES OF THE EXTENT OF TVI IN 72 NEIGHBORHOODS

DISTANCE FROM SUBJECT (FT) / ITEM	0-50	50-200	200-500	500-1000	Total
(1) Estimated No. of Dwellings	146	1033	3426	8043	12,648
(2) Number of Respondents	67	204	149	143	563
(3) Respondents with TVI (any source)	41	110	64	44	259
(4) Item (3) as a percent of Item (2)	61	54	43	31	46
(5) Estimated No. of Dwellings with TVI (any source)	89 (68-113)	557 (442-685)	1471 (1073-1926)	2475 (1663-3418)	4592 (3542-5773)
(6) Item (5) Total Divided by 72 cases	-	-	-	-	64 (49-80)
(7) Respondents with TVI (Subject source)2/	29	49	4	0	82
(8) Item (7) as percent of Item (2)	43	24	3	0	15
(9) Estimated No. of Dwellings with TVI (Subject source)	63 (45-84)	248 (172-335)	92 (0-209)	0	403 (301-505)
(10) Item (9) Total divided by 72 cases	-	-	-	-	6 (4-7)

2/ The respondent was able to identify the subject by name or FCC call sign.

Nationwide Estimates of the Extent of TVI

An attempt was made to generalize the neighborhood estimates of CB-related TVI to produce an approximation for the number of individuals affected nationwide. It should be noted that there may be problems in attempting to extend the neighborhood estimates; these problems are discussed later in this Appendix. The following is a list of fourteen steps by which the nationwide estimates were produced:

(1) An estimated six dwellings per case in the Neighborhood Survey received TVI and could identify the subject as the source. Of these, two have complained to the FCC about this interference. This compares favorably with the actual figure of 1.8 complaints received about each subject in the Neighborhood Survey;

(2) From Item (1), FOB averaged two complaints about each CB operator causing TVI;

(3) In Fiscal Year 1976, FOB received 45,210 CB-related TVI complaints;

(4) From the Neighborhood Survey, of those persons receiving TVI who had filed a complaint with the FCC 87 percent were able to identify (by name or FCC call sign) the subject as the source of the interference;

(5) From (3) and (4), in Fiscal Year 1976, FOB received approximately 39,300 CB-related TVI complaints in which the specific CB operator causing the interference could be identified;

(6) From (2) and (5), FOB in Fiscal Year 1976, received complaints about 20,000 distinct CB operators causing TVI;

(7) The probability of someone complaining about a CB operator who causes TVI and who can be identified by name or FCC call sign was approximately .33 (two out of six). The probability of not complaining, then, was .67 (four out of six);

(8) The probability of none of the six dwellings in Item (1) complaining was (2/3)x(2/3)x(2/3)x(2/3)x(2/3)x(2/3)=.09. Thus, there were an additional 2,000 CB operators who caused TVI, and could be identified, but about whom no one complained. This brings the total number of distinct CB operators causing TVI in Fiscal Year 1976 to 22,000. A 95-percent confidence interval about this estimate would be 18-32 thousand CB operators;

(9) An estimated 64 dwellings received TVI in each neighborhood in the Neighborhood Survey;

(10) According to FOB Fiscal Year 1976 complaint statistics, 85 percent (43,210 out of 51,287) of all TVI complaints were CB-related (this is a conservative estimate for the Neighborhood Survey universe);

(11) From (9) and (10), approximately 54 dwellings per subject received CB-related TVI;

(12) The very high correlation between nearness to the subject and the likelihood of TVI (see Appendix AB) indicated that nearly all of the CB-related TVI in each neighborhood was caused by only one CB operator, namely, the subject;

(13) Recent Census Bureau statistics state that the nationwide average of individuals per household is approximately 3.0. Although there may be more than one household per dwelling, nearly all of the dwellings surveyed were of the single-family type; and

(14) From (8), (11), (12) and (13), in Fiscal Year 1976, an estimated 4 million individuals in the U.S. received CB-related TVI. A 95-percent confidence interval about this estimate would be 1-10 million individuals.

Difficulties in Making a Nationwide Estimate

There were several factors which may preclude the generalization of the neighborhood estimates of the extent of TVI to national estimates. These problems arise from the fact that the Neighborhood Survey was originally designed only to produce estimates of the extent of interference to television reception by a CB transmitter in a neighborhood in which the interference was objectionable enough that a complaint had been filed with the FCC.

The first problem was that the 72 neighborhoods surveyed in this study were selected on the basis of a written complaint concerning interference to television reception from a CB transmitter. Furthermore, it was required that the complainant be able to identify the subject, and also that the neighborhood be located within 150 miles of one of the six participating offices (see Appendix Y for complete details). The cases for investigation were then randomly selected from the cases meeting these criteria; however, each neighborhood in this study may not have been "typical" of the average neighborhood in the country. The nationwide estimate was thus based on the number of CB-related TVI complaints in which the source of the interference could be identified.

Another difficulty in extending the neighborhood estimates to national estimates involved differences among the six locations used for the Neighborhood Survey. For example, TVI was received by 55 percent of the respondents in San Francisco, but only by 36 percent of the respondents in Norfolk. This difference was tested (see Appendix AB) and found to be significant at the .05 level. There is a possibility, then, that the average extent of TVI for these six locations may not have been typical of the nationwide average.

Perhaps a more meaningful estimate of the extent of TVI would have taken into account the fact that interference is multidimensional; ideally, it should be measured in terms of its severity, as well as its occurrence. Data concerning the severity of interference was collected during both the Technical and Neighborhood Surveys, but there was insufficient time to fully study this aspect of the interference problem.

A fourth possible problem concerned intermittent interference caused by mobile CB operators. Persons living near a major roadway are susceptible to TVI from mobile operators living outside of the 1000-foot neighborhood. However, statistical tests on incidence of TVI and nearness to the subject indicated that mobile interference was insignificant in the cases investigated. Whether this problem of interference by mobile CB operators is significant in other types of neighborhoods or in other sections of the country is not presently known. For this as well as the other reasons discussed above, care should be exercised in the use of the national estimate of the extent of CB-related TVI.

INTERVIEWS- 563 # W/O IX- 262 # W/ IX- 301 AVE. LENGTH OF INT(MIN)- 8

		IX			B/W			SS			MAKE															METAL CAB		
		YES	NO	NR	YES	NO	NR	YES	NO	NR	AD	GE	HI	MA	MU	PA	PH	RC	SE	SO	WA	ZE	OT	NR	AGE	YES	NO	NR
1A.TV	#1	256	297	10	80	269	214	202	92	269	19	30	7	23	1	6	14	65	24	16	3	65	72	218	4	40	295	228
	#2	48	36	479	48	27	488	31	24	508	3	12	0	5	0	3	1	9	10	5	2	10	15	488	5	7	63	493
	#3	3	8	552	8	1	554	3	2	558	1	2	0	1	0	0	0	1	0	0	0	1	3	554	4	2	7	554
B.RADIO		89	372	102	0	0	0	108	20	435	2	21	0	3	0	11	1	5	11	5	1	7	50	445	4	19	122	422
C.AUDIO		56	339	168	0	0	0	60	10	493	1	2	2	2	0	3	2	2	9	5	0	1	46	488	4	17	54	492

MISSING DATA- 108

3A.VIEWING FREQUENCY	NEVER	1-60 M/D	1-4 H/D	5-8 H/D	9+ H/D	NR
TV	3	12	129	117	33	7
RADIO	13	72	95	35	27	59
REC/TAPES	49	87	47	11	5	102

B.INTERFERENCE	OCCASIONALLY	DAILY	WEEKENDS	OTHER	NR
	113	151	22	15	0

C.DURATION - 18

4A.ABLE TO ID SOURCE IX YES-115 NO-162 UNCERTAIN- 23 NR- 1

B.HOW VOICES CONV.- 71 ANTENNA INST.- 9 IX WHEN SOURCE AT HOME- 2 OTHER- 41 NR-178

C.SOURCE SUBJECT- 89 NEIGHBORHOOD CB- 16 DON'T KNOW- 2 OTHER- 17 NR-177

D.WAS SOURCE REPORTED TO BE SUBJECT YES-100 NO-150 NR- 51

E.REPORTED TO FCC YES- 34 NO-263 UNCERTAIN- 2 NR- 2
DATE/OFFICE N/N-268 Y/Y- 27 Y/N- 1 N/Y- 5

F.REASON FOR NOT COMPLAINING	0	1	2	3	4	5	6	7	8	9
	47	90	5	36	34	16	16	1	2	54

5.APPROX. DIST. BET. SUBJECT AND RESPONDENT (FT)-	0-50	50-200	200-500	500-1000	NR
	67	204	149	143	0

6.SUBJECT INFORMATION

LINEAR NO- 40 YES(PWR MEASURED)- 17 YES(PWR NOT MEAS.)- 14 NR- 0

MAX POWER- 32

ANTENNA DIRECTIONAL- 33 NON-DIRECTIONAL- 38 NR- 0 RELATIVE GAIN- 6 SWR-1.6

HARMONIC OUTPUT(RELATIVE TO FND.) 54 2ND 54 3RD 42 7TH

SIGNAL STRENGTH OF SELECTED CHANNELS- 56 CH2 59 CH5 58 CH9

SUMMARY OF NEIGHBORHOOD SURVEY INTERVIEWS

2.

	NON-IRRIT. SET 1	SET 2	SET 3	SLIGHT. IRRIT. SET 1	SET 2	SET 3	VERY IRRIT. SET 1	SET 2	SET 3
TELEVISION									
VIDEO - BLACKOUT	0	0	0	2	1	0	18	6	0
VIDEO - CO-CHANNEL	1	0	0	2	0	0	8	3	0
VIDEO - CROSS-HATCHING	3	0	0	19	3	0	35	9	2
VIDEO - DEFECTIVE RECEIVER	1	0	0	1	0	0	5	0	0
VIDEO - ELECTRICAL - MILD	10	0	0	16	3	0	7	0	0
VIDEO - ELECTRICAL - SEVERE	2	0	0	5	2	0	13	4	0
VIDEO - FRINGE AREA RECEPTION	0	1	0	0	0	0	6	1	0
VIDEO - GHOSTING	1	0	0	3	2	0	7	1	0
VIDEO - MODULATION BARS	4	0	0	34	7	0	67	12	2
VIDEO - NEGATIVE	0	0	0	2	0	0	3	2	0
VIDEO - (OTHER)	1	0	0	4	1	0	8	2	0
AUDIO - ELECTRICAL	1	0	0	1	0	0	6	1	0
AUDIO - VOICES	1	0	0	10	2	0	33	8	1
AUDIO - VOICES (SPECIFIC FREQS.)	2	0	0	12	1	0	13	3	0
AUDIO - VOICES (ALL FREQUENCIES)	0	0	0	11	1	0	34	8	1
AUDIO - (OTHER)	0	0	0	1	0	0	2	0	0
RADIO									
AUDIO - DEFECTIVE RECEIVER	0	0	0	1	0	0	0	0	0
AUDIO - ELECTRICAL	1	0	0	8	0	0	12	4	2
AUDIO - FRINGE AREA RECEPTION	1	0	0	2	0	0	1	0	0
AUDIO - VOICES	2	0	0	5	0	0	24	0	0
AUDIO - VOICES (SPECIFIC FREQS.)	0	0	0	0	0	0	3	0	0
AUDIO - VOICES (ALL FREQUENCIES)	1	1	0	8	1	1	25	4	0
AUDIO - (OTHER)	2	0	0	1	0	0	0	0	0
AUDIO DEVICES									
AUDIO - DEFECTIVE EQUIPMENT	0	0	0	0	0	0	1	0	0
AUDIO - VOICES	1	0	0	7	2	0	37	1	1
AUDIO - (OTHER)	1	0	0	2	0	0	2	0	0

MISSING DATA - 9

SUMMARY OF NEIGHBORHOOD SURVEY INTERVIEWS

APPENDIX C

TRANSMITTER ANTENNA LINE HARMONIC RADIATION AND LOW-PASS FILTER

Measurements of harmonic attenuation levels at each transmitter's rf output terminal (harmonic antenna radiation) were made and similar measurements were made at the output of the FCC low-pass filter [1/] inserted in the antenna feedline. Another identical set of measurements was made for the illegally used linear amplifiers.

Graphs C1 through C12 illustrate the harmonic levels observed. For purposes of illustration, the readings were grouped into 6-dB intervals. Note that the category "not measurable" constitutes a significant portion of the data. As used here "not measureable" indicates the harmonic signal level was below the noise floor of the spectrum analyzer as operated. Realistically, the noise floor appears to initially become a problem at approximately 70 dB.

Another listing of measured harmonic antenna radiation is set forth in Tables C1 and C2. In these tables the listings are divided into categories corresponding to emission limitations set forth in the Commission's Rules. [2/] "Transmitters type accepted

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1/ See Appendix X.

2/ 47 CFR 95.617.

before September 10, 1976, must attenuate harmonics at least 43 + 10 log (mean power in watts) decibels. Transmitters type accepted after September 10, 1976, must attenuate harmonics at least 60 decibels (mean power in watts)." The listings are for all tested transmitters and illegally utilized linears and make no distinction for the type acceptance date of an individual unit.[3/]

To determine the relationship of transmitter harmonic antenna radiation to actual TV interference, the suppression values of harmonic antenna radiation were listed for only those cases exhibiting interference attributed to it. Again, they were grouped into categories corresponding to emission limitations set forth in the Commission's Rules. The findings, listed in Table C3, reflect on the adequacy of present suppression requirements. Unfortunately, the limitations of the measurement procedure forced a high percentage of the cases to be classified as "not measurable." Thus, an upper limit was not set. A theoretical treatment of this subject indicates the limit would be in the range of 82 to 118 dB,[4/] depending on several factors.

3/ A list of all tested transmitters is contained in Appendix U.

4/ W. L. Hand, "Personal Use Radio (CB) and Its Effects on TV Reception," IEEE Transactions on Consumer Electronics, (February 1977), p. 12

TABLE C1

TRANSMITTER HARMONIC ANTENNA RADIATION

	Transmitter Only			Transmitter and Low-Pass Filter		
	Harmonic			Harmonic		
Level in dB	2nd	3rd	4th	2nd	3rd	4th
Less than 43 + 10 log (mean power in watts)	14 (20%)	6 (9%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)
At least 43 + 10 log (mean power in watts) and less than 60	25 (36%)	22 (32%)	9 (16%)	2 (3%)	1 (1%)	1 (2%)
At least 60	23 (33%)	30 (43%)	22 (39%)	32 (46%)	27 (40%)	11 (21%)
Not Measurable	7 (10%)	11 (16%)	25 (45%)	35 (51%)	39 (57%)	40 (77%)

Note: Some of the percentages listed throughout this report are based on a small sample size.

TABLE C2

LINEAR AMPLIFIER HARMONIC ANTENNA RADIATION

	Linear Amplifier Only			Linear Amplifier and Low-Pass Filter		
	Harmonic			Harmonic		
Level in dB	2nd	3rd	4th	2nd	3rd	4th
Less than 43 + 10 log (mean power in watts)	10 (93%)	11 (73%)	10 (71%)	4 (25%)	4 (27%)	1 (7%)
At least 43 + 10 log (mean power in watts)	0 (0%)	2 (13%)	2 (14%)	3 (19%)	2 (13%)	2 (13%)
At least 53 + 10 log (mean power in watts)	0 (0%)	0 (0%)	0 (0%)	1 (6%)	1 (7%)	3 (20%)
At least 60	0 (0%)	3 (20%)	4 (29%)	8 (50%)	5 (33%)	5 (33%)
Not Measurable	1 (7%)	2 (13%)	2 (14%)	8 (50%)	8 (53%)	9 (60%)

TABLE C3

TRANSMITTER HARMONIC ANTENNA RADIATION
FOR THOSE CASES EXPERIENCING INTERFERENCE
FROM HARMONIC ANTENNA RADIATION

Transmitter Only

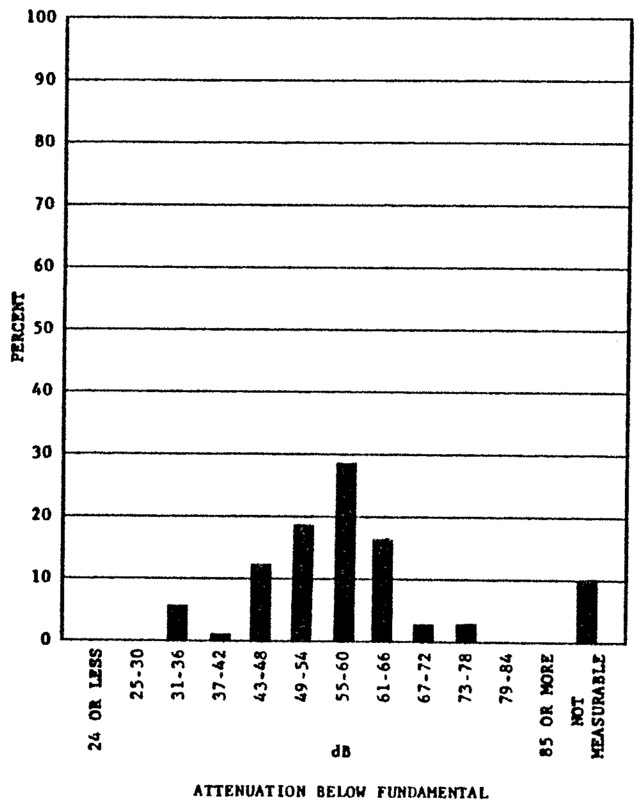
	Harmonic	
Level in dB	2nd	3rd
Less than 43 + 10 log (mean power in watts)	3 (23%)	1 (15%)
At least 43 + 10 log (mean power in watts)	2 (15%)	5 (38%)
At least 60	4 1/ (31%)	2 2/ (15%)
Not Measurable	4 (31%)	4 (31%)

1/ Actual values 60, 62, 65, 66 dB.

2/ Actual values 65, 67 dB.

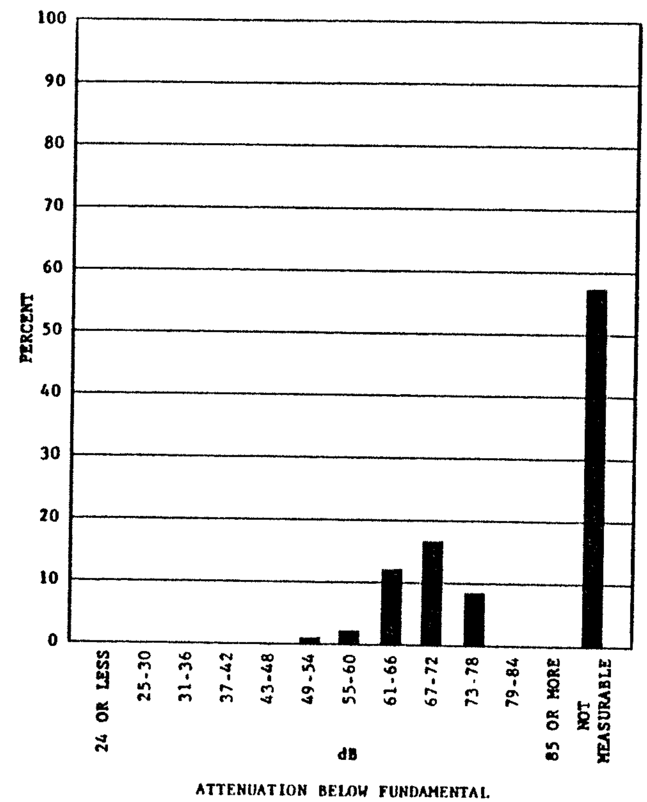
GRAPH C1

TRANSMITTER 2ND HARMONIC
ANTENNA LINE RADIATION
(SAMPLE SIZE = 69)



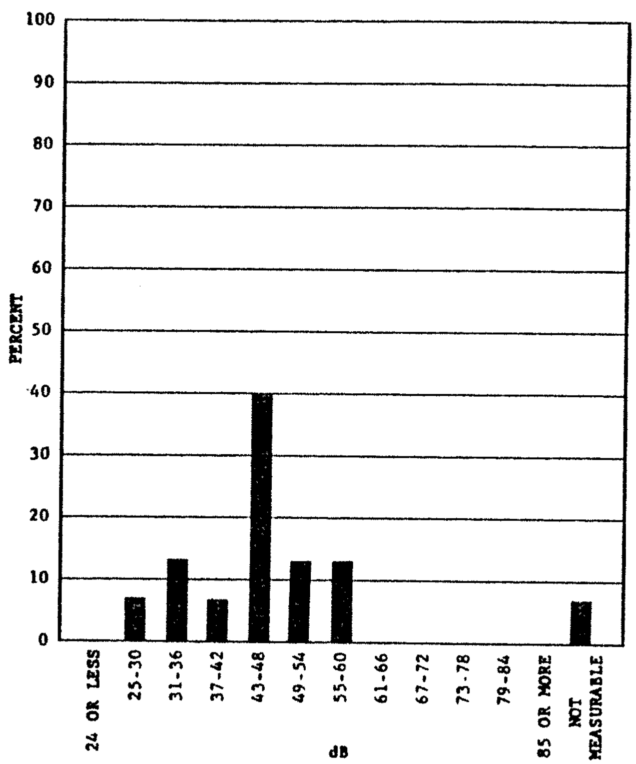
GRAPH C2

2ND HARMONIC ANTENNA LINE RADIATION FROM TRANSMITTER
EQUIPPED WITH IN-LINE LOW-PASS FILTER
(SAMPLE SIZE = 69)



GRAPH C3

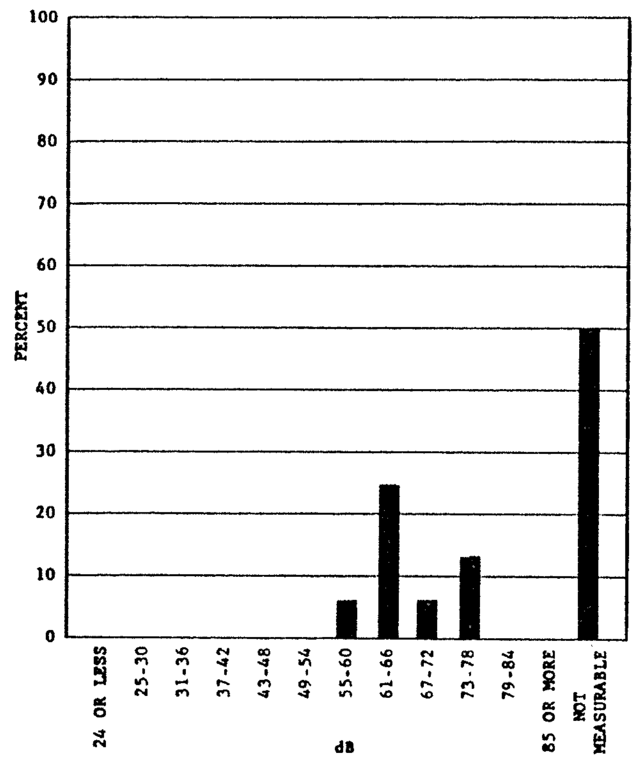
TRANSMITTER PLUS LINEAR 2ND HARMONIC
ANTENNA LINE RADIATION
(SAMPLE SIZE = 15)



ATTENUATION BELOW FUNDAMENTAL

GRAPH C4

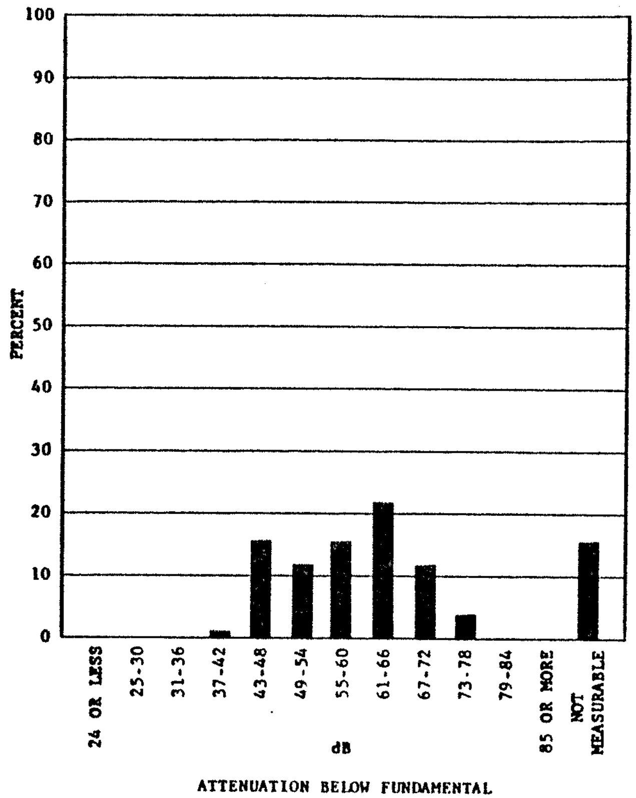
2ND HARMONIC ANTENNA LINE RADIATION FROM TRANSMITTER
PLUS LINEAR EQUIPPED WITH IN-LINE LOW-PASS FILTER
(SAMPLE SIZE = 16)



ATTENUATION BELOW FUNDAMENTAL

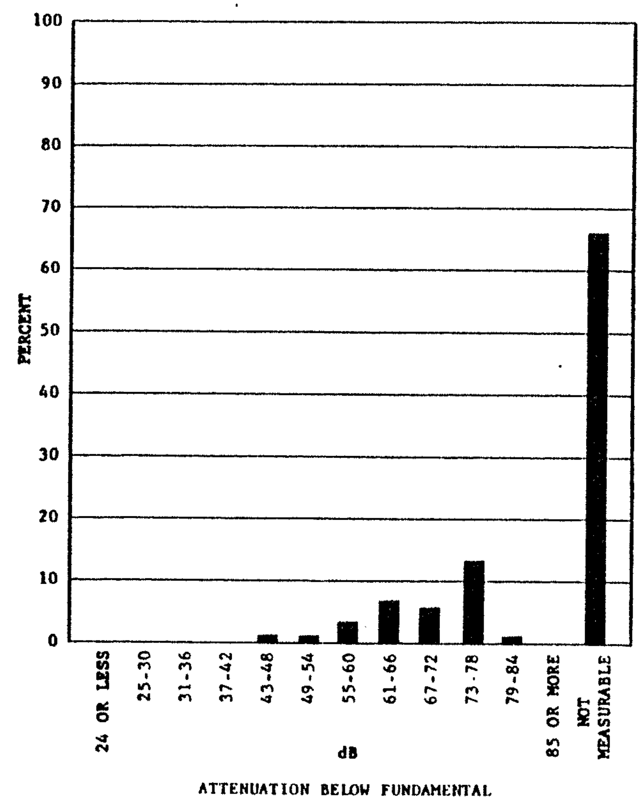
GRAPH C5

TRANSMITTER 3RD HARMONIC
ANTENNA LINE RADIATION
(SAMPLE SIZE = 68)



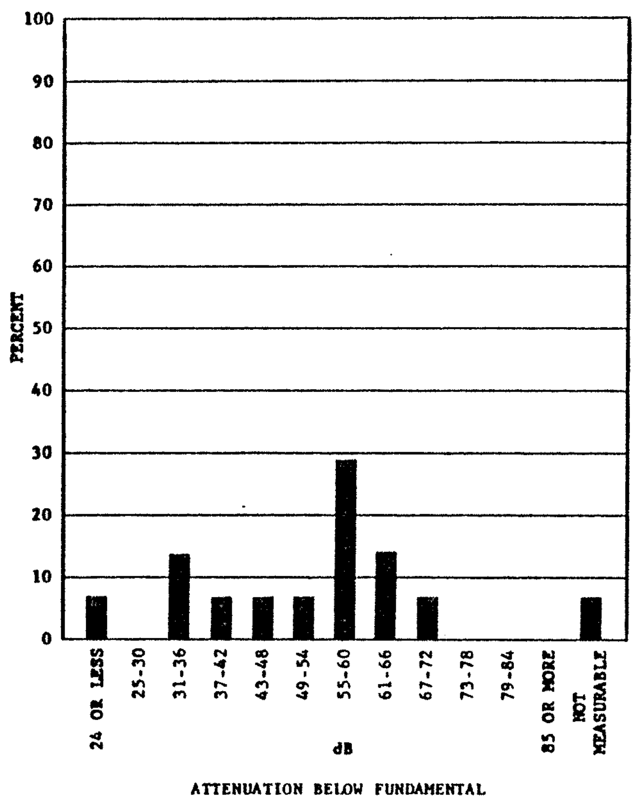
GRAPH C 6

3RD HARMONIC ANTENNA LINE RADIATION FROM TRANSMITTER
EQUIPPED WITH IN-LINE LOW-PASS FILTER
(SAMPLE SIZE = 68)



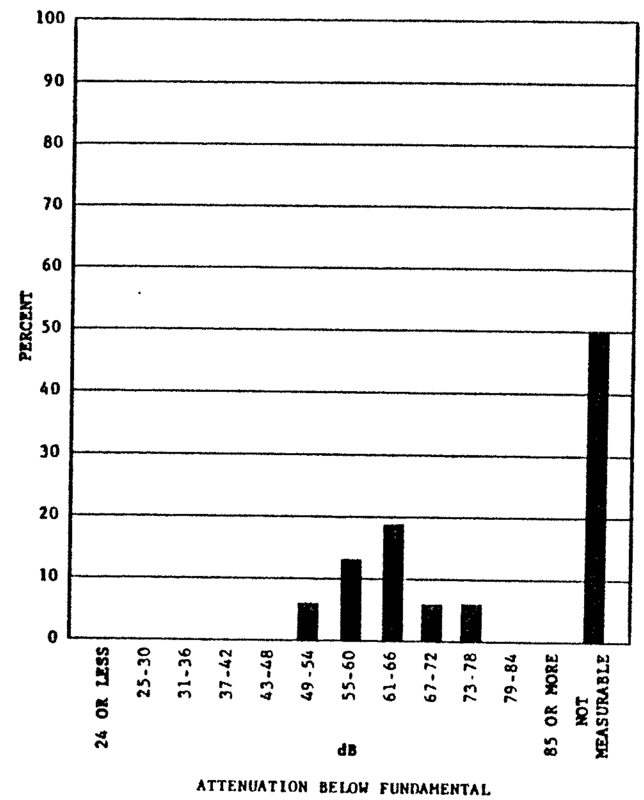
GRAPH C7

TRANSMITTER PLUS LINEAR 3RD HARMONIC
ANTENNA LINE RADIATION
(SAMPLE SIZE = 14)



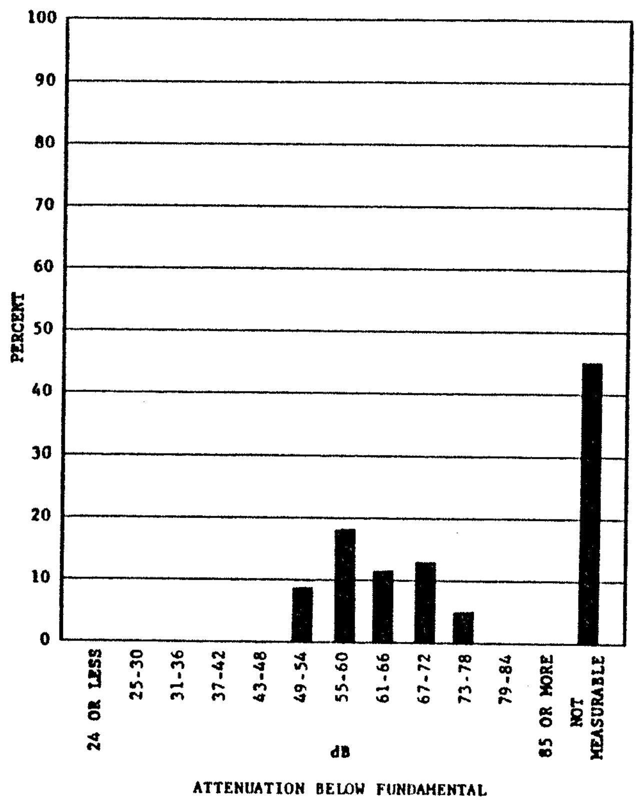
GRAPH C8

3RD HARMONIC ANTENNA LINE RADIATION FROM TRANSMITTER
PLUS LINEAR EQUIPPED WITH IN-LINE LOW-PASS FILTER
(SAMPLE SIZE = 16)



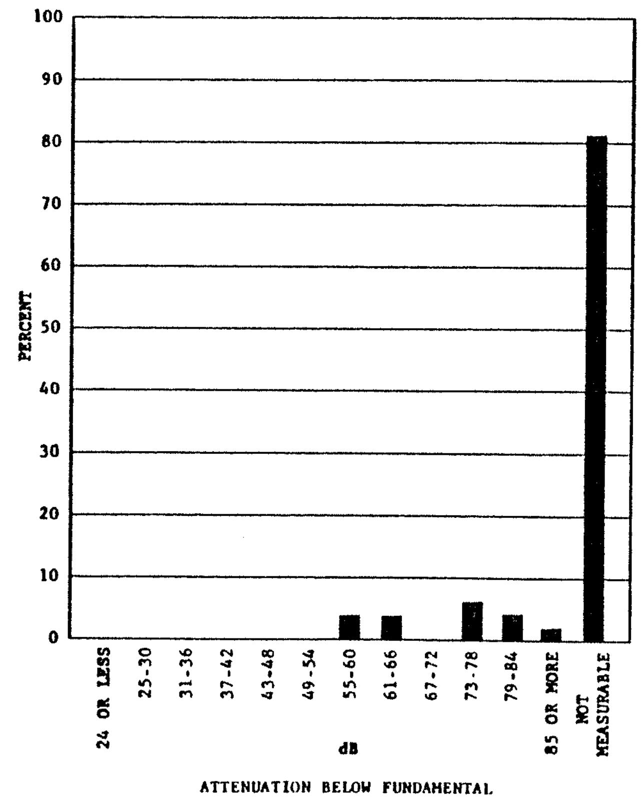
GRAPH C9

TRANSMITTER 4TH HARMONIC
ANTENNA LINE RADIATION
(SAMPLE SIZE = 56)



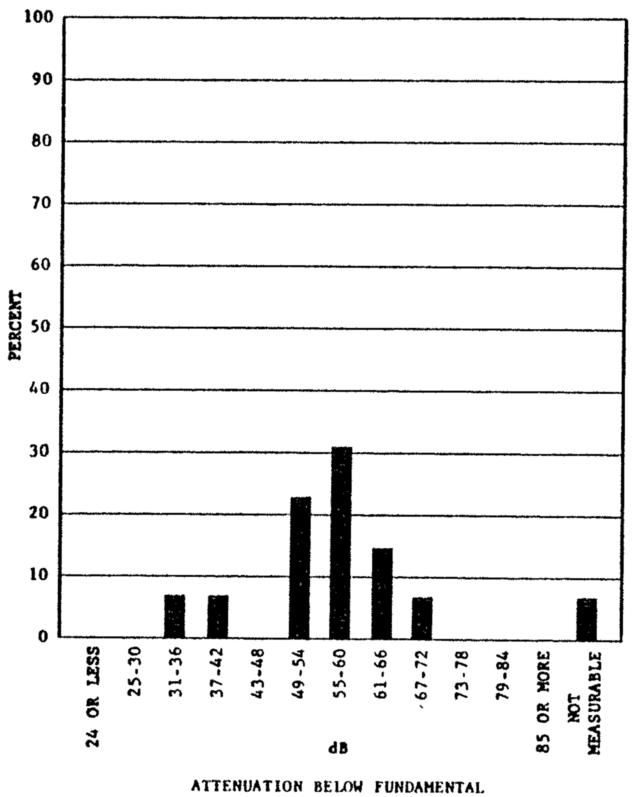
GRAPH C10

4TH HARMONIC ANTENNA LINE RADIATION FROM TRANSMITTER
EQUIPPED WITH IN-LINE LOW-PASS FILTER
(SAMPLE SIZE = 52)



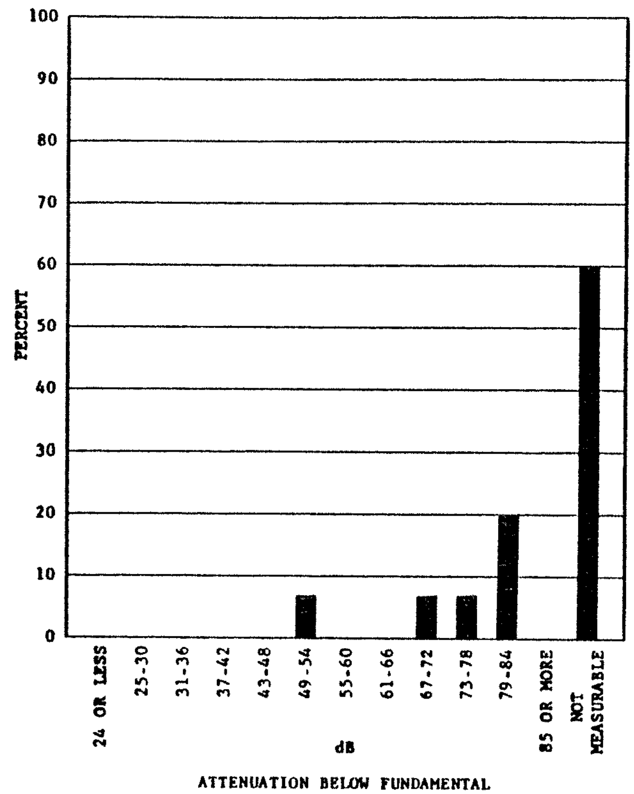
GRAPH C11

TRANSMITTER PLUS LINEAR 4TH HARMONIC
ANTENNA LINE RADIATION
(SAMPLE SIZE = 13)



GRAPH C12

4TH HARMONIC ANTENNA LINE RADIATION FROM TRANSMITTER
PLUS LINEAR EQUIPPED WITH IN-LINE LOW-PASS FILTER
(SAMPLE SIZE = 15)



APPENDIX D

TRANSMITTER CHASSIS HARMONIC RADIATION

Harmonic attenuation levels of radiation emitted from the transmitting system by way of some path other than the transmitter's rf output terminal (harmonic chassis radiation) were explored. External speakers, microphones and power cords provide normal escape routes for chassis radiation. True measurements of emission levels require an open field test range or special enclosure, both of which were beyond the practical constraints of this study. However, an indication of harmonic chassis radiation was obtained by operating the CB transmitter into a dummy load and thus eliminating all radiation through the CB antenna system. Any interference then observed on a TV receiver was emanating from some abnormal radiation path, i.e., chassis radiation.

As it was not feasible to devise an on-scene measurement procedure that would quantify chassis radiation in absolute values, perhaps the most meaningful way to demonstrate the impact of chassis radiation is to simply state that 11 percent of all active interference cases observed in this study were attributed solely to chassis radiation, and an additional 14 percent were partially attributed to chassis radiation. The total impact was 25 percent of the observed interference. If those cases where harmonically related TV channels (2, 5 or 9) were not viewed were excluded, chassis radiation was totally responsible for 14 percent of the interference and partially responsible for an additional 18 percent of the interference for a total impact of 32 percent of the cases.

APPENDIX E

TV RECEIVER OVERLOAD AND HIGH-PASS FILTER

In addition to receiving a desired signal, a television receiver must also be able to reject all other (undesired) signals which are simultaneously present in the frequency spectrum. A strong signal on some frequency [1/] well removed from the television channel frequency of interest can cause the television receiver to generate spurious emission products that disrupt normal reception. Such interference is known as receiver overload and is self-induced. The maximum level of undesired signal that can be tolerated without observing interference varies among receivers and TV channel being viewed and is largely a function of characteristics which may not be theoretically well understood. Also, an externally applied device, called a high-pass filter, can be inserted in the receiver antenna line to decrease susceptibility to overload by attenuating undesired signals prior to their entering the TV receiver.

It was beyond the scope of this report to determine why receiver overload occurs. Rather, emphasis was centered on its impact on the total interference picture, contributing conditions, and effectiveness of the high-pass filter.[2/]

1/ Twenty-seven MHz for purposes of this report.

2/ The willingness of the complainant to utilize a high-pass filter is also of concern. This study found approximately 84 percent of the complainants and CB operators were agreeable toward implementing a mutually cooperative solution.

Of the cases investigated and exhibiting interference, 36 percent was classified as totally due to receiver overload and an additional 9 percent partially due to receiver overload. Thus, receiver overload was associated with 45 percent of the complaints. Virtually all of this interference was only exhibited on the complainant's TV receiver. The FCC receiver[3/] was affected by receiver overload in four percent of the cases.

When the overload interference occurred, 42 percent was on all received TV channels and 33 percent was only on one or more of the harmonic TV channels (2, 5 and 9). As expected, the single factor that most determined the probability of a complaint being caused by receiver overload was received TV channels. If one of the CB harmonic TV channels were not received, there was a high likelihood that receiver overload was the cause of the complaint. This survey found 100 percent of the interference problems were attributed to receiver overload when TV channel 2, 5 or 9 was not a viewable channel.[4/] However, in those areas where TV channel 2, 5 or 9 was received and viewed, the distribution of causes of an interference complaint was: (1) 75 percent other than receiver overload; (2) 15 percent totally receiver overload; and (3) 10 percent a combination of receiver overload and some other problem.

3/ See Appendix X.

4/ Audio rectification excluded.

The high-pass filter [5/] was employed to eliminate the interference by installing it in a hang-on fashion at the antenna terminals of the complainant's TV receiver. A preferred method would have been to install the filter at the TV tuner input; however, such an installation would have been impractical for this study.

In those cases diagnosed as receiver overload or partially receiver overload, the hang-on high-pass filter completely resolved all interference in 63 percent of the cases, [6/] partially resolved the interference in 17 percent of the cases and had no effect on the interference in 21 percent of the cases.

A final item of interest relating to receiver overload is the level of undesired signal that was necessary to produce self-induced interference. One case exhibited overload interference with a CB fundamental signal level of only 56 dBuV across 300 ohms at the TV antenna terminals. However, this was an extreme exception. The normally encountered low undesired signal level was 76 dBuV across 300 ohms and a mean value was 89 dBuV across 300 ohms. Graph E1 shows the distribution of undesired signal levels that were associated with overload interference.

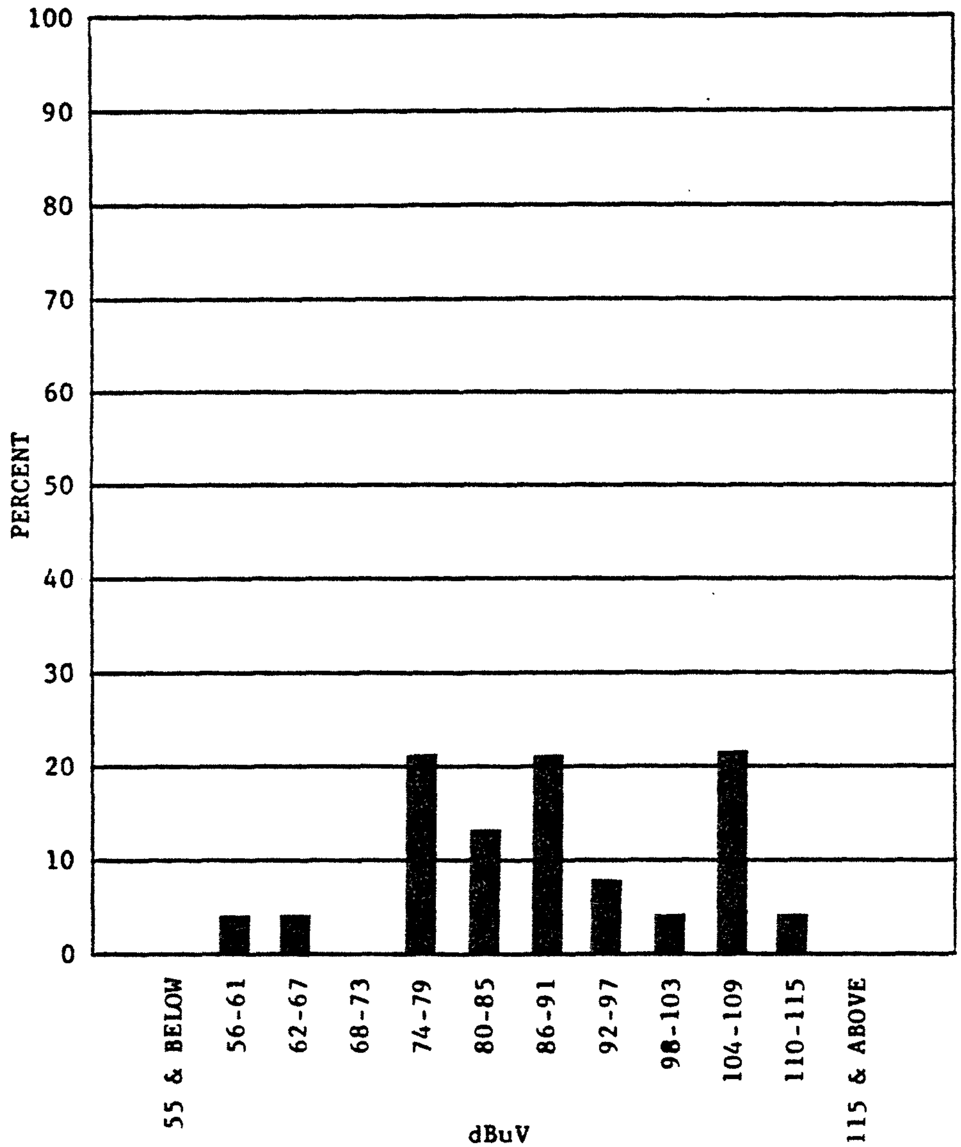
5/ See Appendix X.

6/ This includes four cases not fully tested, but evidence indicates the high-pass filter would have been effective.

GRAPH E1

UNDESIRED SIGNAL (27 MHz) LEVELS AT TV ANTENNA
TERMINALS FOR THOSE CASES CLASSIFIED
AS RECEIVER OVERLOAD

(IN dBuV ACROSS 300 OHMS)
(SAMPLE SIZE = 24)



APPENDIX F

LINEAR RF POWER AMPLIFIERS

What percent of the CB stations associated with a TV-CB interference complaint use a linear amplifier and what percent of the TV-CB interference complaints would be eliminated if linear amplifiers were not used? This appendix provides statistics to answer these major questions.

A linear amplifier was associated with 46 percent of the CB stations involved in this study. This figure was determined by off-the-air measurements, station inspections, licensee statements and in a few instances, overwhelming circumstantial evidence.

Where a linear amplifier was involved, 54 percent of the interference cases were automatically resolved when the CB transmitter was operated without the linear. Also, in those instances where interference remained, it was substantially reduced in severity and number of channels affected.

Other statistics relating to linear amplifiers are discussed in the various other appendix items.

APPENDIX G

RECEIVED TV CHANNELS AND EFFECT ON INTERFERENCE PROBABILITY

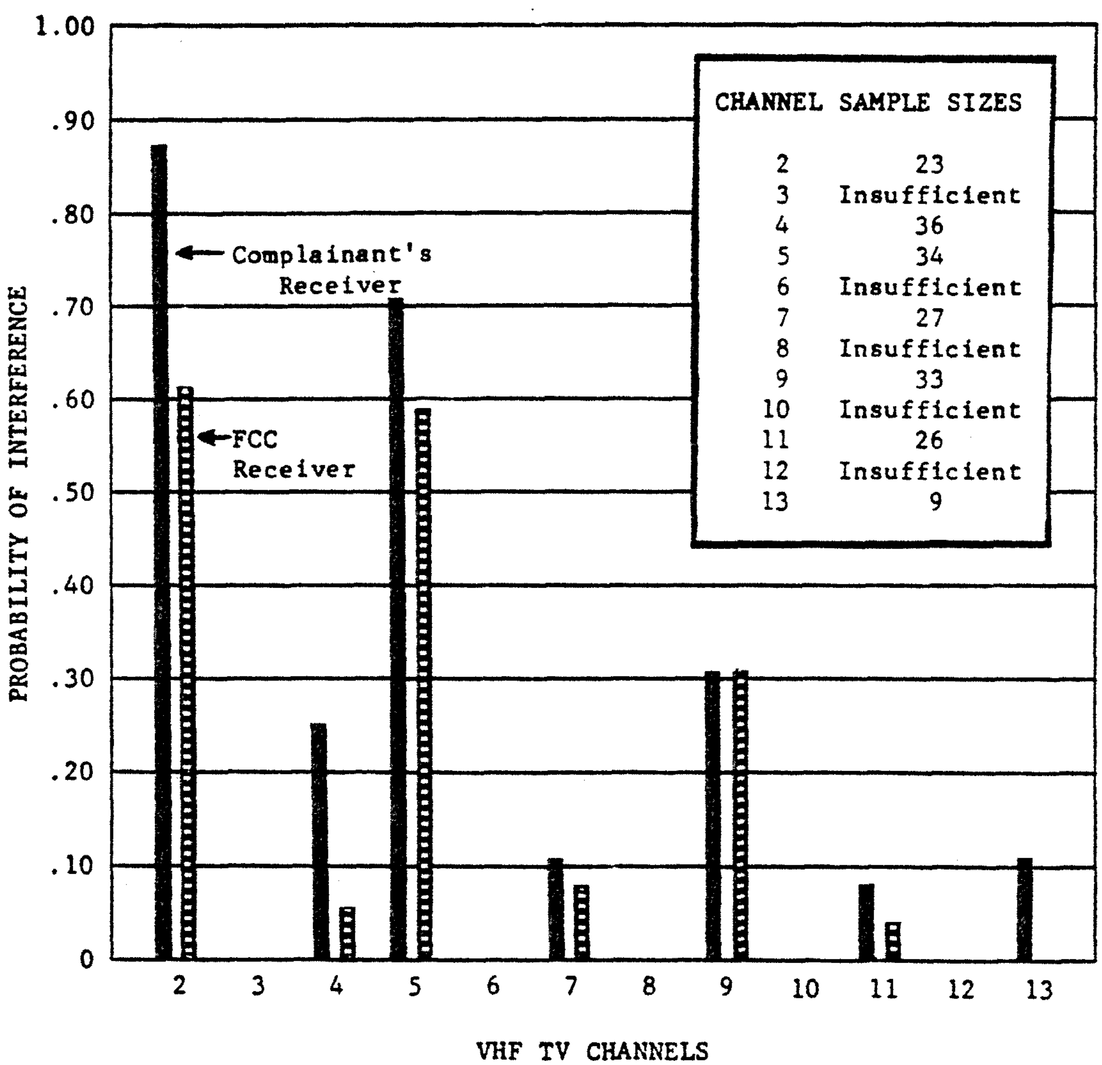
The complainant's television receiving system was observed and rated on the TASO scale on each viewable TV channel. The FCC television receiver was then connected to the complainant's antenna system and similarly rated on the TASO scale on each viewable TV channel. All tests were conducted with the CB station not transmitting and repeated with the CB station transmitting. Using this data the probability of interference associated with CB transmissions was determined for the individual television channels. Note that as used here, interference constitutes normal reception of a TV channel on either the complainant's or the FCC TV receiver being degraded at least one TASO grade by the CB transmissions.

When the probabilities were computed it was obvious that two distinct situations were present. In those cases where CB harmonically related TV channels 2 or 5, and to a lesser extent 9, were viewed, interference was most probable on the harmonically related channels and decreased with increasing channel number. Also, the FCC TV receiver exhibited much of the same interference experienced by the complainant's TV receiver. This is illustrated by Graph G1. In those cases where TV channels 2, 5 or 9 were not viewed, the probability of interference on the complainant's receiver was very high on every channel and decreased somewhat with increasing channel number. Only a negligible amount of interference was experienced on the FCC TV receiver. This is illustrated by Graph G2. The sample size for data contained in Graph G2 is small, 7 cases investigated by the Norfolk office, and only available for TV channels 3, 10 and 13.[1/]

1/ See Table 1, page 8.

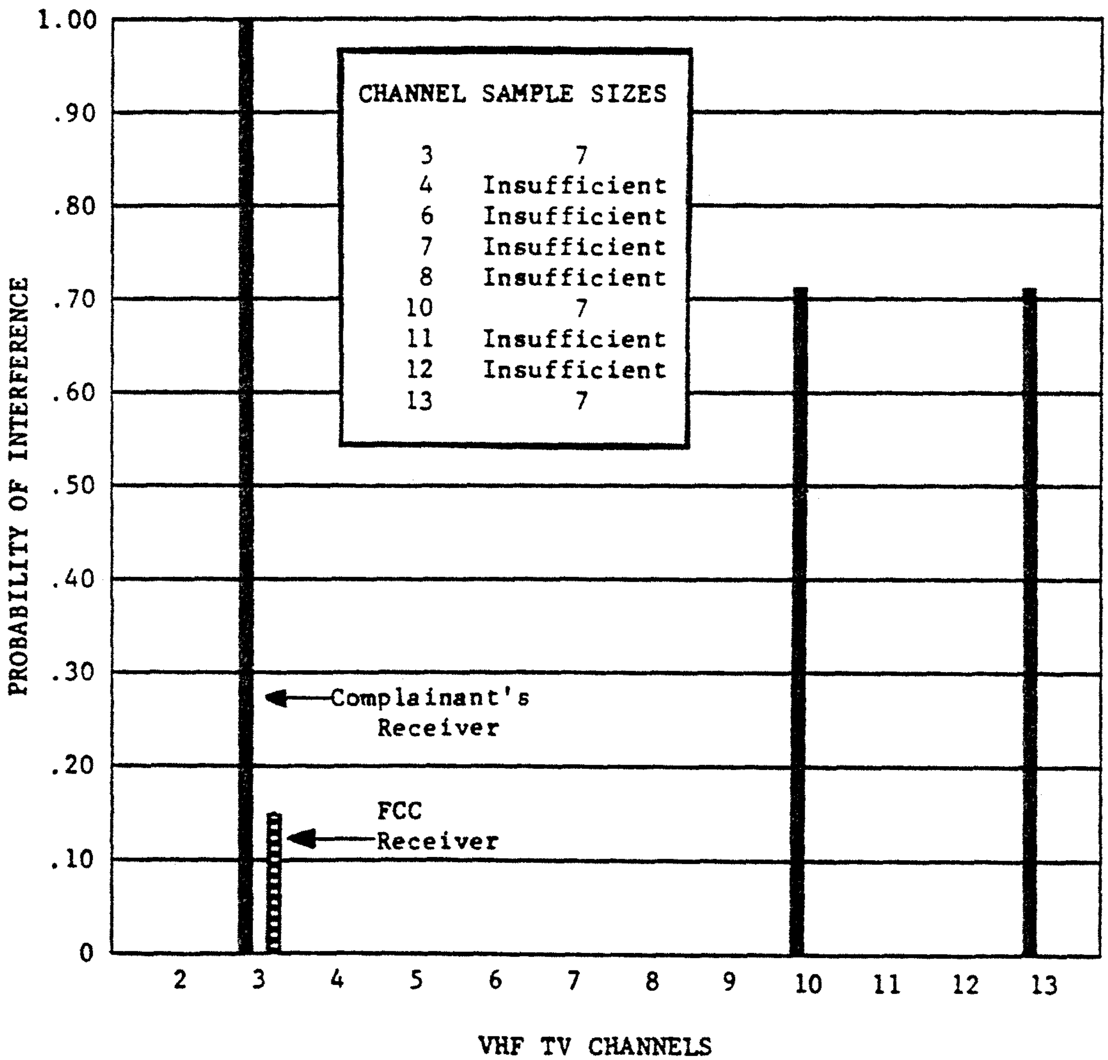
GRAPH G1

PROBABILITY OF RECEIVING TV INTERFERENCE ON A PARTICULAR TV CHANNEL WHEN INTERFERENCE IS RECEIVED ON AT LEAST ONE CHANNEL AND CHANNEL 2, 5 OR 9 IS A VIEWED CHANNEL



GRAPH G2

PROBABILITY OF RECEIVING TV INTERFERENCE ON A PARTICULAR TV CHANNEL WHEN INTERFERENCE IS RECEIVED ON AT LEAST ONE CHANNEL AND CHANNEL 2, 5 OR 9 IS NOT A VIEWED CHANNEL



APPENDIX H

PHYSICAL SEPARATION OF CB AND TV

Standards for transmitter harmonic suppression levels and television receiver signal rejection levels become more severe as protection is assumed for TV receivers located increasingly close to a CB transmitter. A practical limit based on cost, benefits and state-of-the-art requires a knowledge of the distance separation between an average complainant residence and subject residence.

For the 72 cases of this study, the distance between each complainant and subject was listed in one of four groupings-- 0-50 feet, 50-200 feet, 200-500 feet or 500-1000 feet. These distances circumscribe four concentric rings progressing in areas by ratios equal to 1, 15, 84 and 300, respectively.

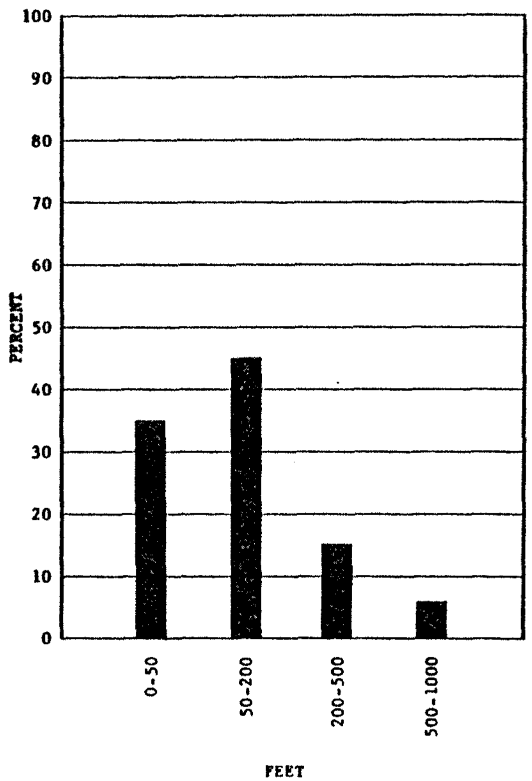
Graphs H1 through H5 illustrate the distribution of complaints within each of the four rings under a variety of transmitting installations representing various classes of effective radiated powers. A discussion of what actual effective radiated powers are represented is set forth in Appendix L. Note that minimum separation was evident when no beam[1/] antenna or linear amplifier was associated with the CB station, while maximum separation was evident when both a beam antenna and linear amplifier were associated with the CB station.

1/ High-gain directional antenna.

GRAPH H1

DISTANCE IN FEET BETWEEN ALL SUBJECTS
AND ALL COMPLAINANTS

(SAMPLE SIZE = 72)

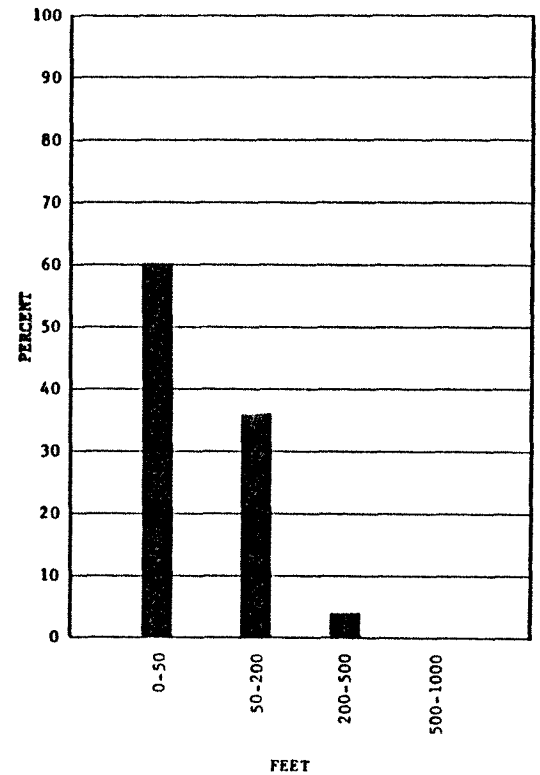


GRAPH H2

DISTANCE IN FEET BETWEEN SUBJECT
AND COMPLAINANT

NO BEAMS AND NO LINEARS

(SAMPLE SIZE = 25)

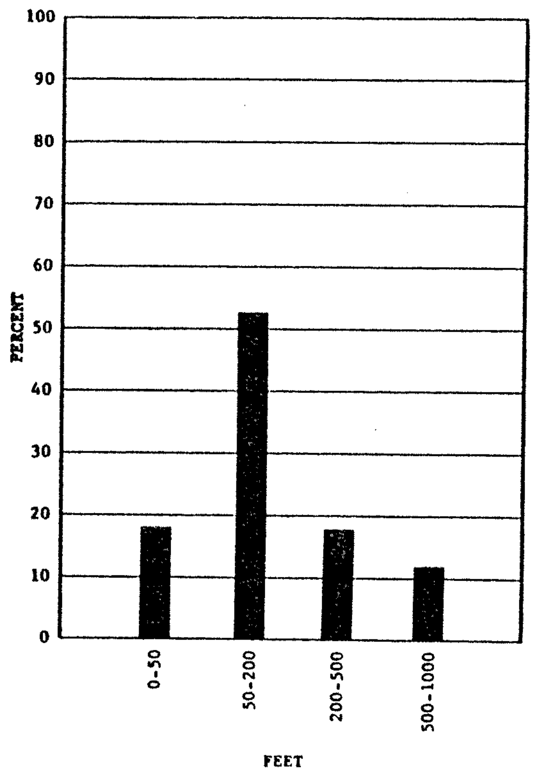


GRAPH H3

DISTANCE IN FEET BETWEEN SUBJECT
AND COMPLAINANT

LINEARS AND BEAMS

(SAMPLE SIZE = 17)

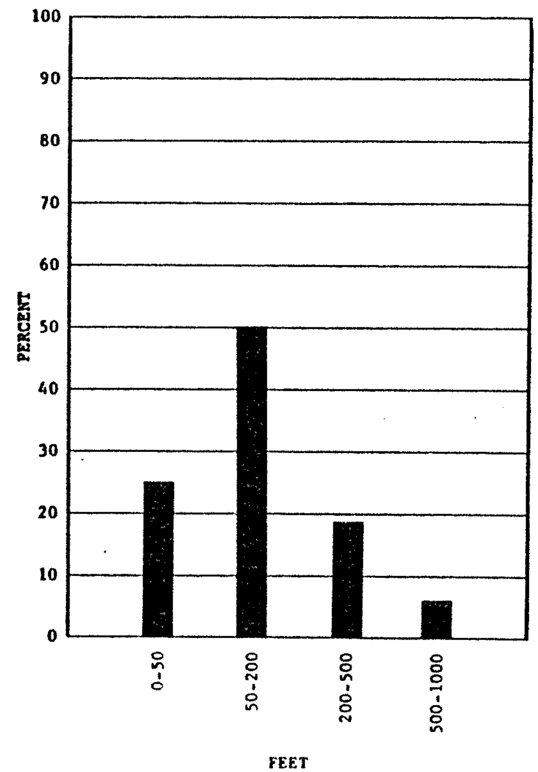


GRAPH H4

DISTANCE IN FEET BETWEEN SUBJECT
AND COMPLAINANT

LINEARS AND NO BEAMS

(SAMPLE SIZE = 16)

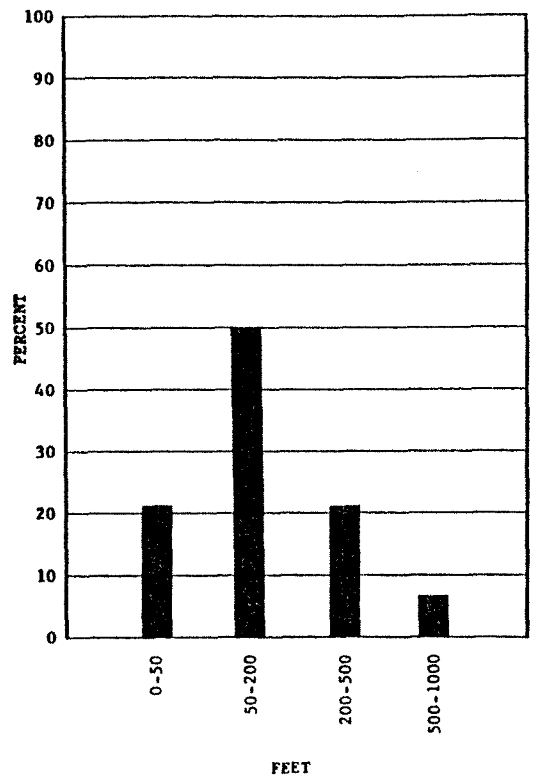


GRAPH H5

DISTANCE IN FEET BETWEEN SUBJECT
AND COMPLAINANT

BEAMS AND NO LINEARS

(SAMPLE SIZE = 14)



APPENDIX I

PICTURE QUALITY OF TV RECEIVERS

A subjective evaluation of normal TV reception and interference severity was obtained by classifying on the TASO scale the picture quality on both the complainant and the FCC receivers on each viewable TV channel. The grading was done first with the CB transmitter inactive (no interference) and then repeated with the CB transmitter active (with interference).[1/] Each TV picture subjective evaluation was rated for quality on the TASO scale from 1 to 6 as follows:

1. Excellent - The picture is of extremely high quality, as good as you could desire.
2. Fine - The picture is of high quality providing enjoyable viewing. Interference is perceptible.
3. Passable[2/] - The picture is of acceptable quality. Interference is not objectionable.
4. Marginal - The picture is poor in quality and you wish you could improve it. Interference is somewhat objectionable.

1/ The terms interference "active" or "inactive" refer to CB generated interference. Other interference may have been present but it would have been taken into account during the initial rating.

2/ Historically a TASO 3 has been taken as the minimum "acceptable" picture quality in determining contours.

5. Inferior - The picture is very poor but you could watch it. Definitely objectionable interference is present.

6. Unusable - The picture is so bad that you could not watch it.

The rating results were grouped in a number of different fashions as illustrated on Graphs I1 through I14. First, Graphs I1 and I2 provide a qualitative rating of the complainant's reception system and any receiver problems contributing to degraded reception. Second, Graphs I3, I4, I5 and I6 provide an indication of the severity of the complainant's reception difficulty. Third, Graphs I7, I8, I9 and I10 illustrate, in general, the severity of interference attributed to some transmitter fault. Fourth, Graphs I11, I12, I13 and I14 illustrate, in general, the severity of interference attributed to some TV receiver overload fault. Note that groups three and four are only a general indication of transmitter fault and receiver fault cases in that interference or lack of interference on the FCC receiver provides for the categorization.

As a brief summary of these graphs, if TASO grades 1, 2 and 3 are considered acceptable picture quality and 4, 5 and 6 considered unacceptable picture quality, a percentage value can be assigned to the various categories. In turn, these percentages allow the levels and changes to be readily displayed. The values are listed in Table I1.

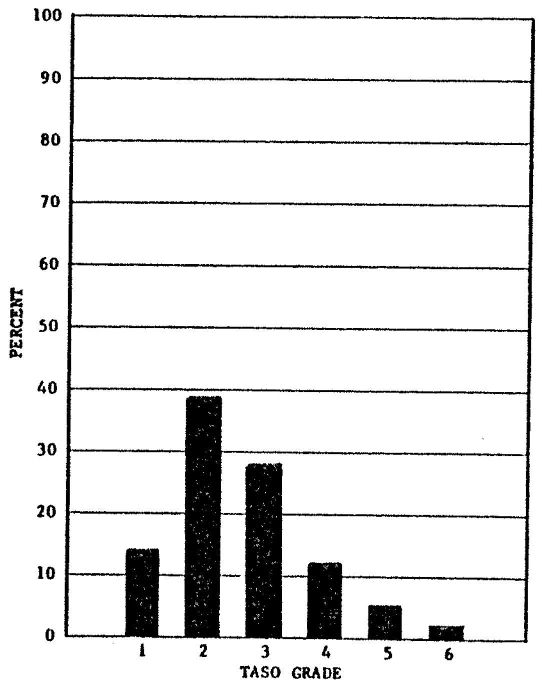
TABLE I1

PICTURE QUALITY CLASSIFICATIONS

	Interference	Acceptable (TASO 3 or better) Comp. TV (%)	Acceptable (TASO 3 or better) FCC TV (%)	Unacceptable (TASO 4 or worse) Comp. TV (%)	Unacceptable (TASO 4 or worse) FCC TV (%)
All TV channels observed	Inactive	81	90	19	10
TV channels observed with interference on the complainant's receiver	Inactive	93	96	7	5
	Active	31	69	69	31
TV channels observed with interference on both the complainant's and the FCC receivers	Inactive	89	93	11	7
	Active	38	39	62	60
TV channels observed with interference on the complainant's receiver only (No interference on the FCC receiver)	Inactive	97	98	4	2
	Active	25	98	75	2

GRAPH I1

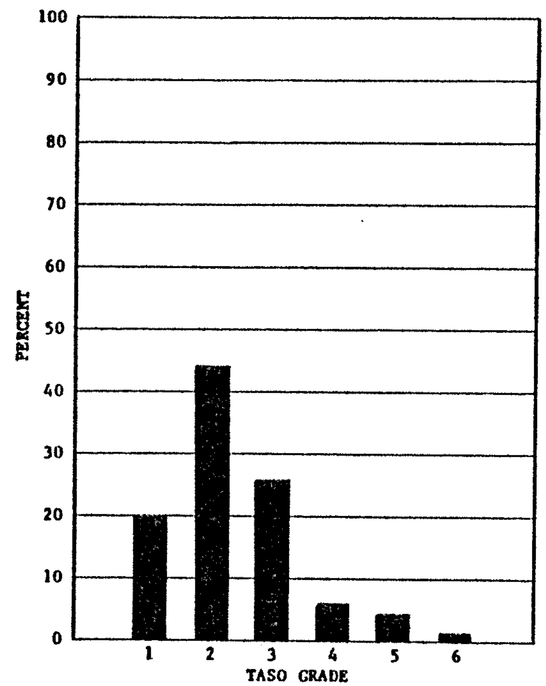
SUBJECTIVE EVALUATION OF ALL TV CHANNELS AS
OBSERVED ON THE COMPLAINANT'S RECEIVER
(INTERFERENCE NOT ACTIVE)



TASO Mean = 2.6
Sample Size = 349

GRAPH I2

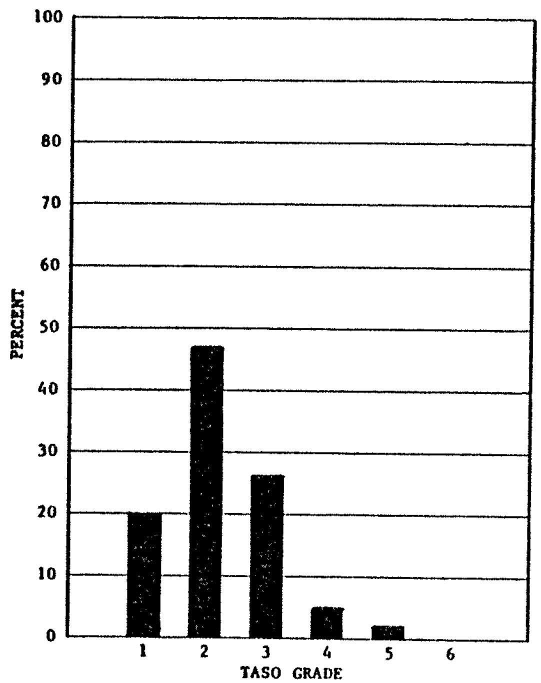
SUBJECTIVE EVALUATION OF ALL TV CHANNELS AS
OBSERVED ON THE FCC RECEIVER
(INTERFERENCE NOT ACTIVE)



TASO Mean = 2.3
Sample Size = 349

GRAPH 13

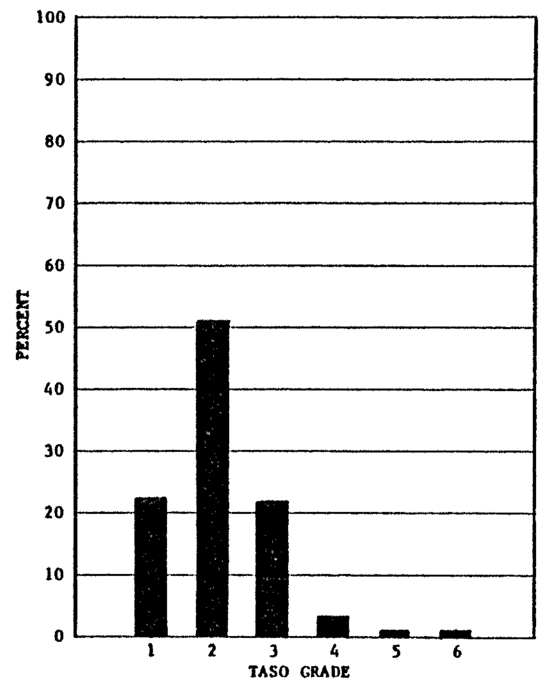
SUBJECTIVE EVALUATION AS OBSERVED ON THE COMPLAINANT'S RECEIVER OF ALL TV CHANNELS EXPERIENCING INTERFERENCE ON THE COMPLAINANT'S RECEIVER
(INTERFERENCE NOT ACTIVE)



TASO Mean = 2.2
Sample Size = 112

GRAPH 14

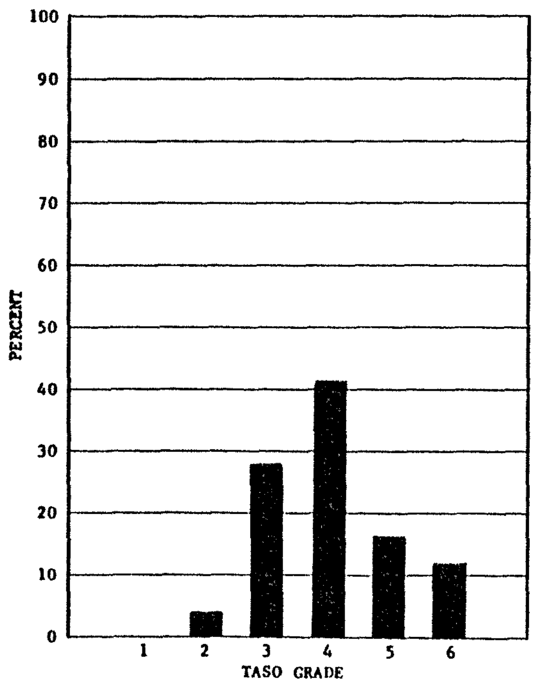
SUBJECTIVE EVALUATION AS OBSERVED ON THE FCC RECEIVER OF ALL TV CHANNELS EXPERIENCING INTERFERENCE ON THE COMPLAINANT'S RECEIVER
(INTERFERENCE NOT ACTIVE)



TASO Mean = 2.1
Sample Size = 112

GRAPH I5

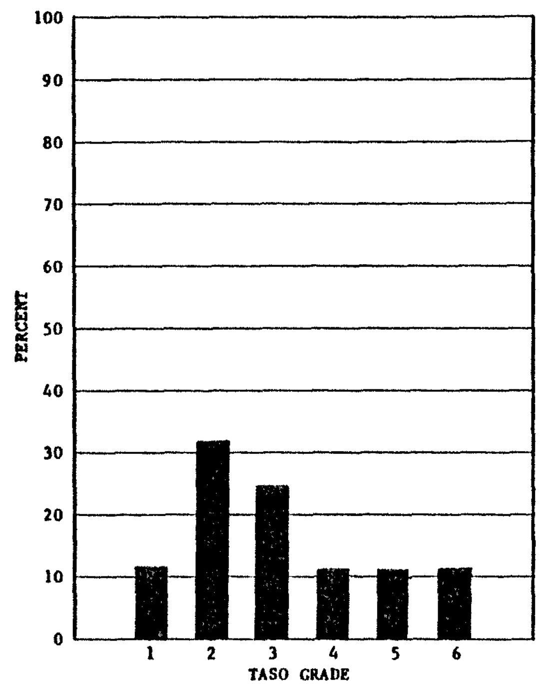
SUBJECTIVE EVALUATION AS OBSERVED ON THE COMPLAINANT'S RECEIVER OF ALL TV CHANNELS EXPERIENCING INTERFERENCE ON THE COMPLAINANT'S RECEIVER (INTERFERENCE ACTIVE)



TASO Mean = 4.0
Sample Size = 112

GRAPH I6

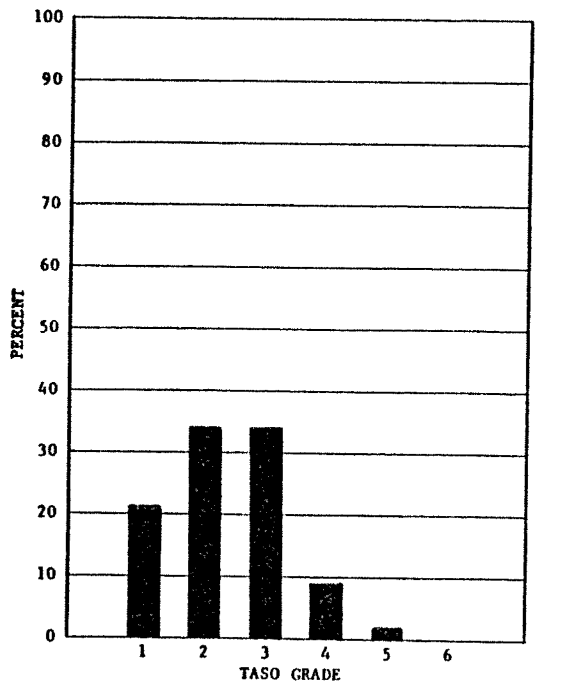
SUBJECTIVE EVALUATION AS OBSERVED ON THE FCC RECEIVER OF ALL TV CHANNELS EXPERIENCING INTERFERENCE ON THE COMPLAINANT'S RECEIVER (INTERFERENCE ACTIVE)



TASO Mean = 3.1
Sample Size = 112

GRAPH I 7

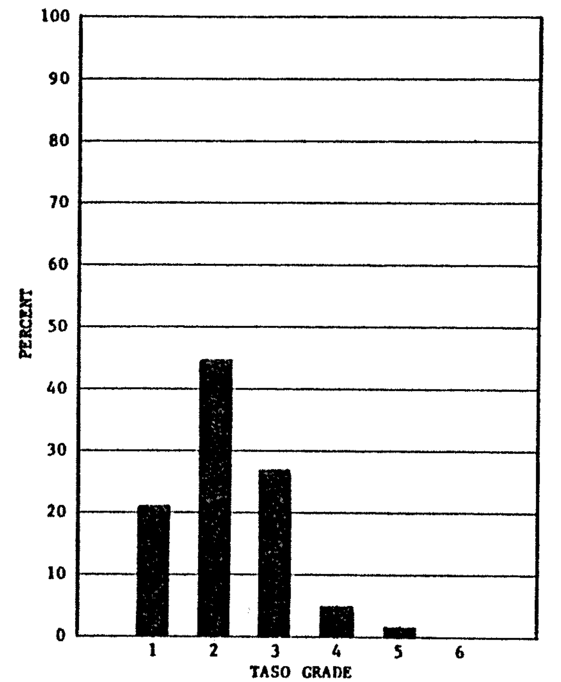
SUBJECTIVE EVALUATION AS OBSERVED ON THE COMPLAINANT'S RECEIVER OF ALL TV CHANNELS EXPERIENCING INTERFERENCE ON BOTH THE COMPLAINANT AND FCC RECEIVERS
(INTERFERENCE NOT ACTIVE)



TASO Mean = 2.4
Sample Size = 56

GRAPH I8

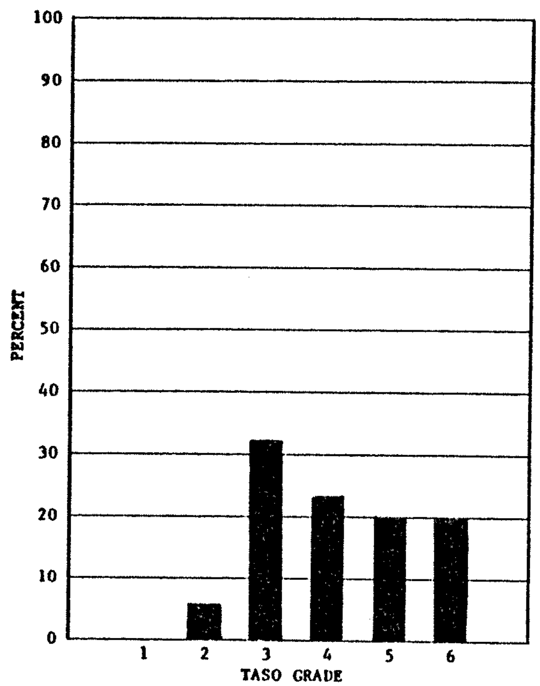
SUBJECTIVE EVALUATION AS OBSERVED ON THE FCC RECEIVER OF ALL TV CHANNELS EXPERIENCING INTERFERENCE ON BOTH THE COMPLAINANT AND FCC RECEIVERS
(INTERFERENCE NOT ACTIVE)



TASO Mean = 2.2
Sample Size = 56

GRAPH I9

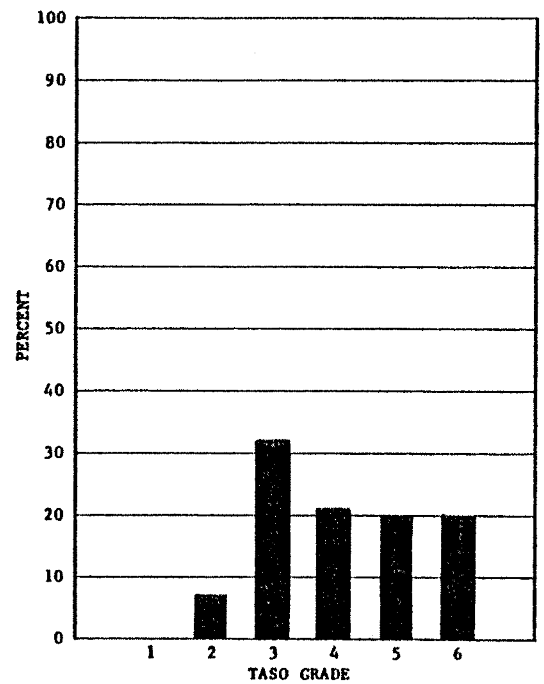
SUBJECTIVE EVALUATION AS OBSERVED ON THE COMPLAINANT'S RECEIVER OF ALL TV CHANNELS EXPERIENCING INTERFERENCE ON BOTH THE COMPLAINANT AND FCC RECEIVERS (INTERFERENCE ACTIVE)



TASO Mean = 4.2
Sample Size = 56

GRAPH I10

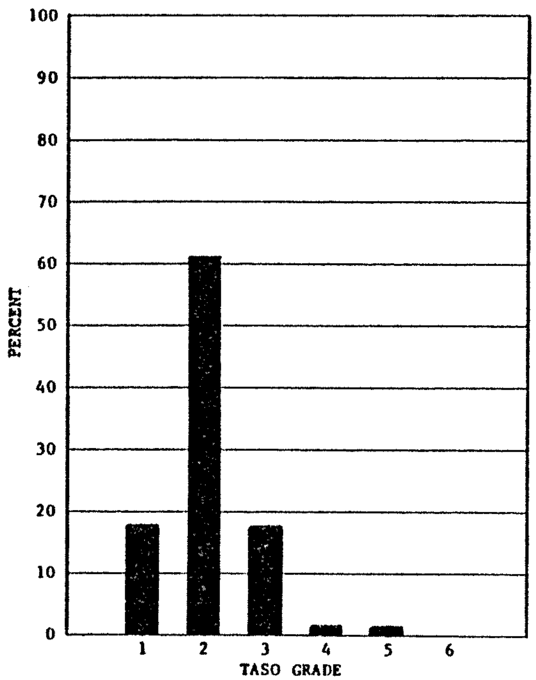
SUBJECTIVE EVALUATION AS OBSERVED ON THE FCC RECEIVER OF ALL TV CHANNELS EXPERIENCING INTERFERENCE ON BOTH THE COMPLAINANT AND FCC RECEIVERS (INTERFERENCE ACTIVE)



TASO Mean = 4.1
Sample Size = 56

GRAPH I11

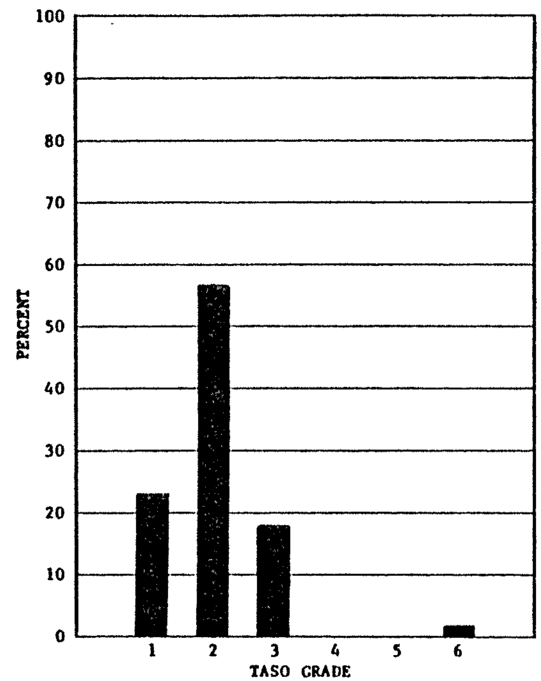
SUBJECTIVE EVALUATION AS OBSERVED ON THE COMPLAINANT'S RECEIVER OF ALL TV CHANNELS EXPERIENCING INTERFERENCE ONLY ON THE COMPLAINANT'S RECEIVER (INTERFERENCE NOT ACTIVE)



TASO Mean = 2.1
Sample Size = 56

GRAPH I12

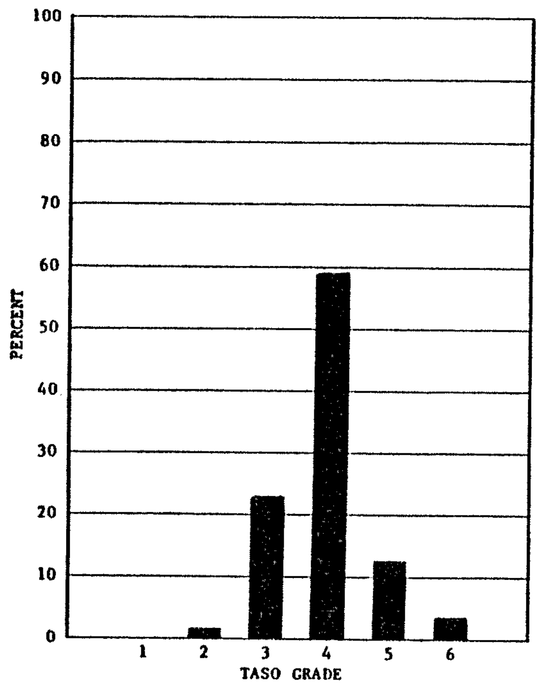
SUBJECTIVE EVALUATION AS OBSERVED ON THE FCC RECEIVER OF ALL TV CHANNELS EXPERIENCING INTERFERENCE ONLY ON THE COMPLAINANT'S RECEIVER (INTERFERENCE NOT ACTIVE)



TASO Mean = 2.0
Sample Size = 56

GRAPH I13

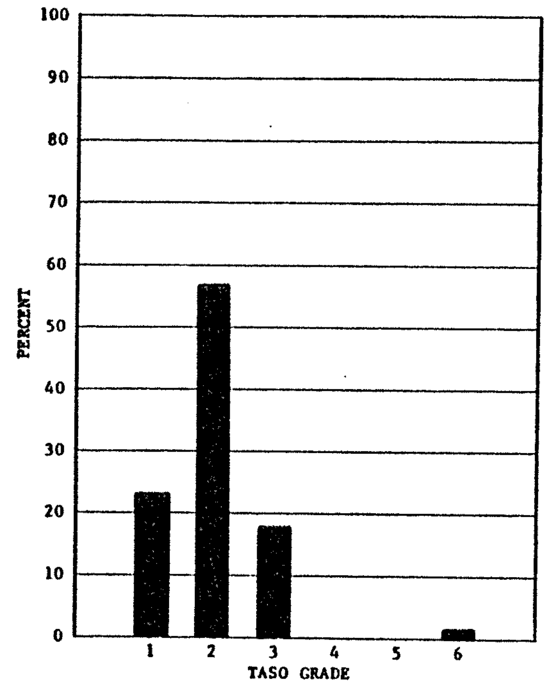
SUBJECTIVE EVALUATION AS OBSERVED ON THE COMPLAINANT'S RECEIVER OF ALL TV CHANNELS EXPERIENCING INTERFERENCE ONLY ON THE COMPLAINANT'S RECEIVER
(INTERFERENCE ACTIVE)



TASO Mean = 3.9
Sample Size = 56

GRAPH I14

SUBJECTIVE EVALUATION AS OBSERVED ON THE FCC RECEIVER OF ALL TV CHANNELS EXPERIENCING INTERFERENCE ONLY ON THE COMPLAINANT'S RECEIVER
(INTERFERENCE ACTIVE)



TASO Mean = 2.0
Sample Size = 56

APPENDIX J

RECEIVED CB SIGNAL LEVELS

The rejection characteristics of television receivers to CB (27 MHz) fundamental overload are a function of the CB and TV station signal levels at the television receiver antenna input terminals. Various articles have addressed this subject through theoretical calculations based on assumptions concerning the transmitting antenna system, receiving antenna system and physical separation. However, levels found in practice appear to have remained undocumented.

To provide the range of CB signal levels that appear at the television receiver antenna input terminals for actual interference cases, measurements were made off the complainant's receiving antenna system. The results of these measurements are illustrated in Graph J1 for CB transmitters and Graph J2 for linear power amplifiers. The levels were all within the range of 55 to 108 dBuV across 300 ohms, with the exception of one case of 116 dBuV, which consisted of a 175-watt output linear, 12-dB gain transmitting antenna, rooftop gain receiving antenna and less than 50-foot physical separation. For all cases the mean value was 90 dBuV across 300 ohms for the CB transmitters and

91 dBuV across 300 ohms for the linear amplifiers.[1/] As a comparison, theoretical calculations indicate at 100 feet, a range of 81 to 123 dBuV across 300 ohms might be expected.[2/]

1/ Although there was little variation in received CB signal strength between linear and nonlinear cases, this was expected because the linear cases, in general, exhibited greater physical separation.

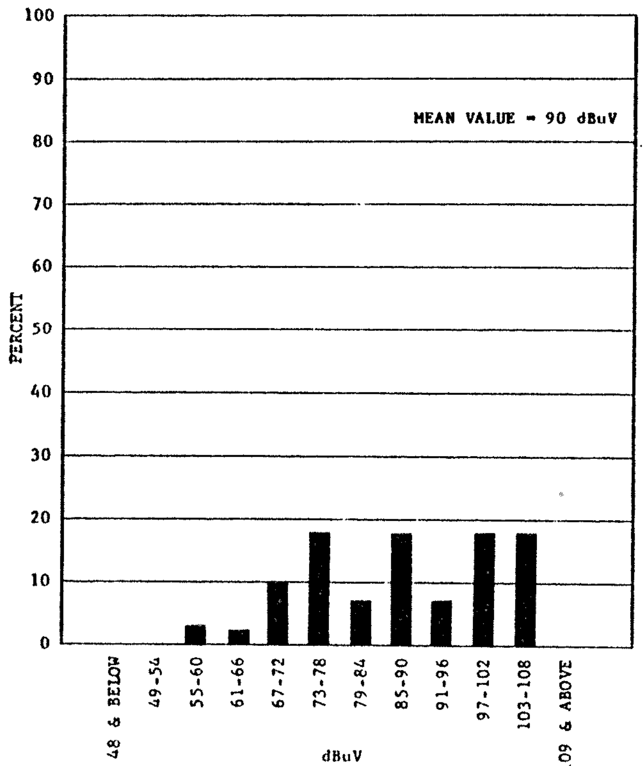
2/ W. L. Hand, "Personal Use Radio (CB) and Its Effects on TV Reception," IEEE Transactions on Consumer Electronics, (February 1977), p. 10.

GRAPH J1

SIGNAL LEVEL OF CB FUNDAMENTAL AS OBSERVED
AT TERMINALS OF COMPLAINANT'S TV ANTENNA

TRANSMITTERS ONLY

(IN dBuV ACROSS 300 OHMS)
(SAMPLE SIZE = 61)

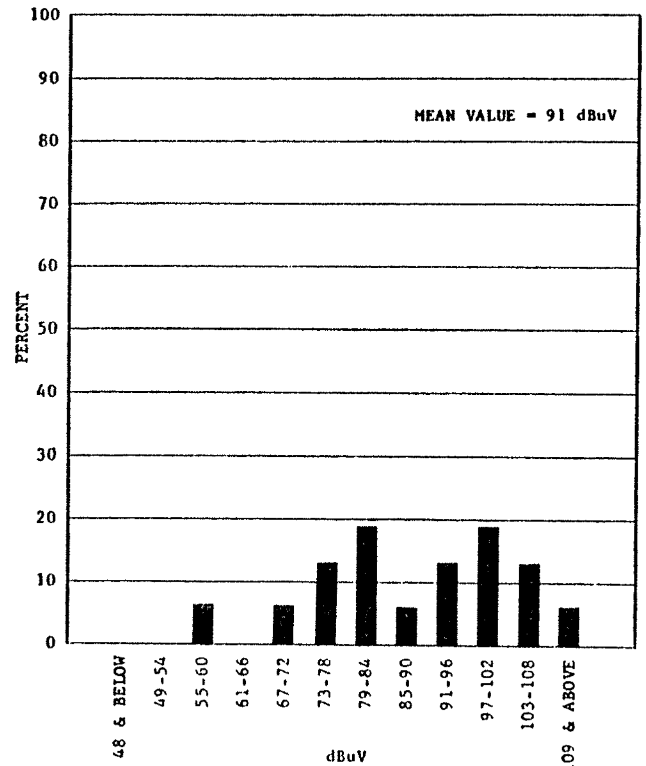


GRAPH J2

SIGNAL LEVEL OF CB FUNDAMENTAL AS OBSERVED
AT TERMINALS OF COMPLAINANT'S TV ANTENNA

POWER AMPLIFIERS ONLY

(IN dBuV ACROSS 300 OHMS)
(SAMPLE SIZE= 16)



APPENDIX K

RECEIVED TV SIGNAL LEVELS

At each complainant's location, the signal levels of the received TV channels were quantified. First, each channel was classified as Grade A, Grade B or Fringe according to theoretical predicted field intensity contours as outlined below and in the Commission's Rules. 1/

TV Channels	Grade A 2/ (dBu)	Grade B (dBu)	Fringe (dBu)
2 - 6	at least 68	at least 47	less than 47
7 - 13	at least 71	at least 56	less than 56

Graph K1 illustrates the distribution by theoretical contour grade of all TV channels received by the complainants. Graph K2 illustrates the distribution by theoretical contour grade of all TV channels received by the complainants and experiencing interference associated with CB transmissions.

Theoretical contour grades are only an indication of the approximate extent of coverage of a TV station. Under actual conditions, the true coverage may vary greatly from these estimates because the terrain over any specific path is expected to be different from the average terrain on which the field strength charts were based. In an attempt to quantify the actual field strength values prevailing at the complainant's residence,

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1/ 47 CFR 73.683

2/ dBu = Field strength in dB above one microvolt per meter. Unfortunately this term is rather easy to confuse with dBuV which is dB above one microvolt.

off-the-air measurements were made at the complainant's residence. Since only a rough indication of the actual contour grade was desired, the standard procedure for making VHF TV field strength measurements as outlined in the TASO [3/] report was not followed, i.e., 30-foot height, grid or chart recorder readings, 6-10 dB gain antenna. Rather, cluster measurements were made just outside the complainant's residence at an average height of approximately ten feet or as close to the complainant's TV antenna as feasible. It should be noted that this is not an attempt to represent TV station coverage but only coverage in the vicinity of the complainants. Graph K3 illustrates the distribution by measured contour grade of all TV channels received by the complainants. Graph K4 illustrates the distribution by measured contour grade of all TV channels received by the complainants and experiencing interference associated with CB transmissions.

A final category of TV channel signal level measurements is the value supplied by the TV receiving system to the antenna input terminals of the TV receiver. For comparison, a level of 49 dBuV across 300 ohms represents the voltage at the TV tuner input terminals corresponding to that quality of service produced by a Grade B field strength contour. [4/5/] Sixty-two dBuV

3/ Engineering Aspects of Television Allocations (1959), p.268.

4/ Robert A. O'Conner, "Understanding Television's Grade A and Grade B Service Contours," IEEE Transactions on Broadcasting, BC-14:no. 4:137 (December, 1968).

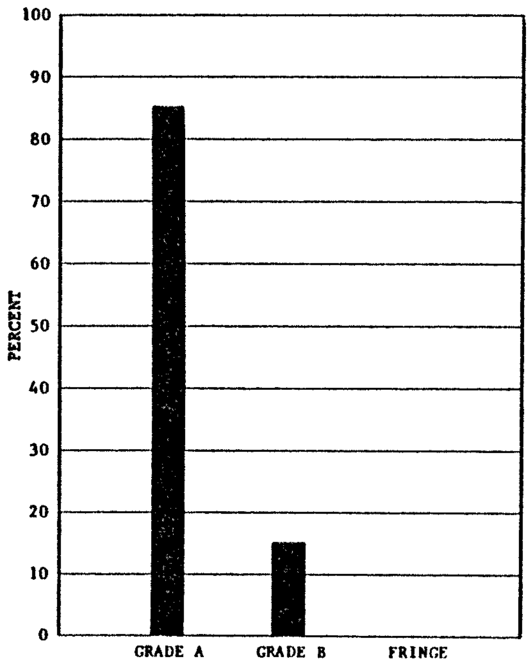
5/ Hector J. Davis and others, Interference to Sample Television Receivers from Frequencies in the Range of 27 MHz, 223 MHz and 900 MHz (Washington, July 1977).

across 300 ohms represents the voltage at the TV tuner input terminals corresponding to that quality of service produced by a Grade A field strength contour for TV channels 2 through 6 and 56 dBuV for TV channels 7 through 13. Also, principal community values exceed the Grade A values by six dB. Primary interest was in the Grade B value so no distinction was maintained between TV channels 2 through 6 and 7 through 13. Graph K5 illustrates the distribution of the voltage level of all TV channels as measured off the complainant's receiving antenna at the TV antenna input terminals. Graph K6 illustrates this same value for only those channels experiencing interference associated with CB transmissions. Graph K7 illustrates the same value for all channels 2 and 5 experiencing interference associated with CB transmissions.

The importance of the TV signal level received at the TV antenna input terminals is illustrated in Graph K8. Here all TV channels were grouped in 6-dB ranges and within each range, the percentage of signals receiving interference was determined. In Graph K9 a similar breakout was provided; however, only TV channels 2 and 5 were included. These graphs (K8 and K9) do not address the actual cause of any interference and any significance should not be expanded without more thorough analysis of underlying causes.

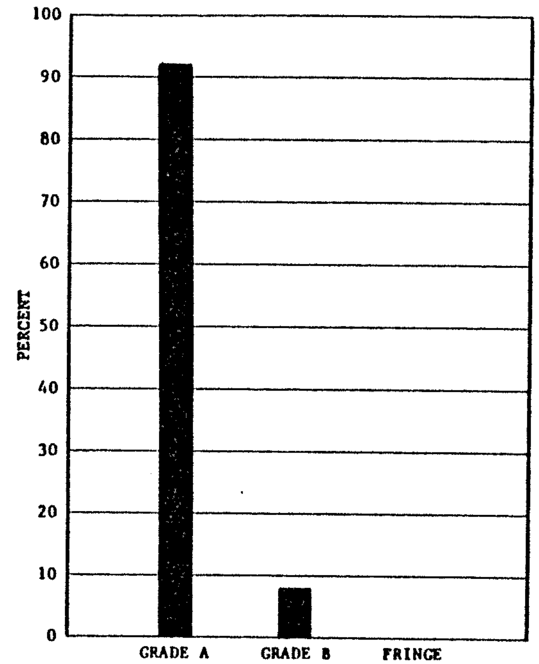
GRAPH K1

THEORETICAL CONTOUR GRADES OF ALL
VHF TV CHANNELS OBSERVED
(SAMPLE SIZE = 321)



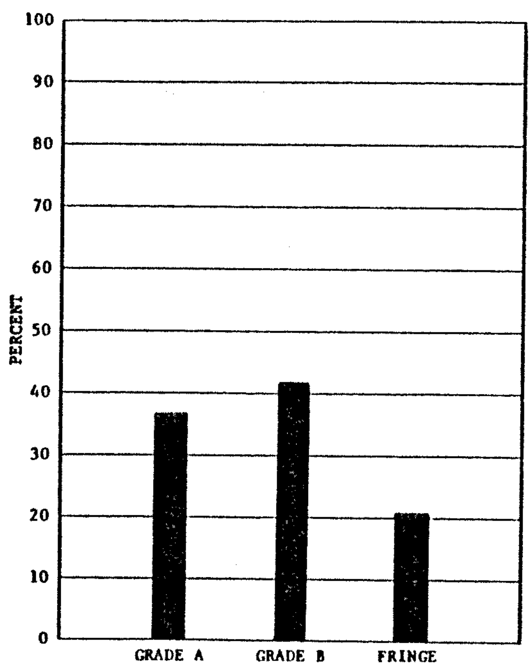
GRAPH K2

THEORETICAL CONTOUR GRADES OF ALL VHF TV CHANNELS
OBSERVED EXPERIENCING INTERFERENCE
(TRANSMITTER OR LINEAR)
(SAMPLE SIZE = 109)



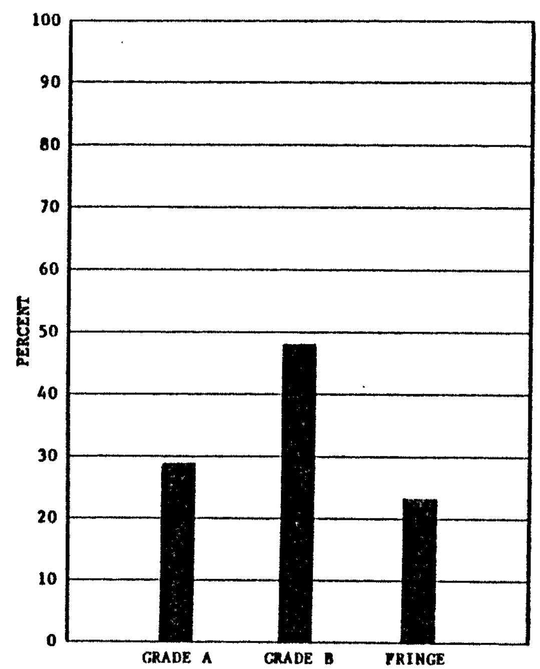
GRAPH K3

MEASURED APPROXIMATIONS OF CONTOUR GRADES
OF ALL VHF TV CHANNELS OBSERVED
(SAMPLE SIZE = 307)



GRAPH K4

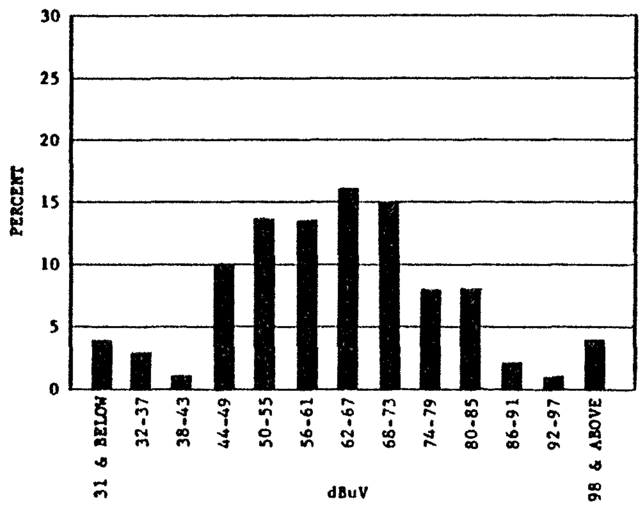
MEASURED APPROXIMATIONS OF CONTOUR GRADES
OF ALL VHF TV CHANNELS OBSERVED
EXPERIENCING INTERFERENCE
(TRANSMITTER OR LINEAR)
(SAMPLE SIZE = 112)



GRAPH K5

TV STATION SIGNAL LEVELS MEASURED AT
COMPLAINANT'S TV RECEIVER ANTENNA TERMINALS
(IN dBuV ACROSS 300 OHMS)

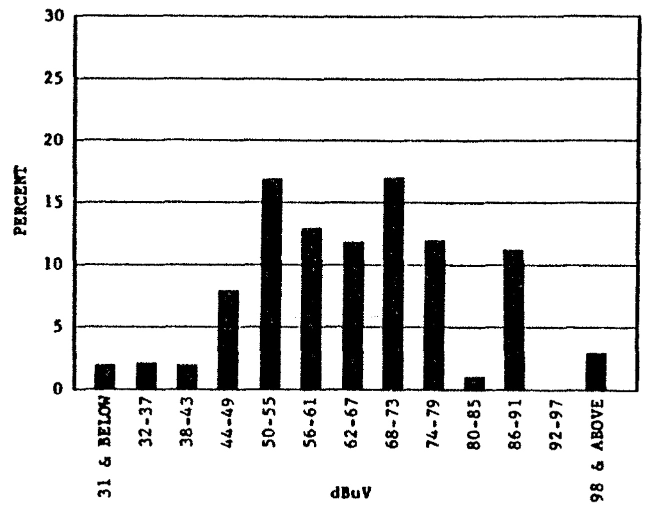
ALL TV CHANNELS 2 THRU 13 OBSERVED



GRAPH K6

TV STATION SIGNAL LEVELS MEASURED AT
COMPLAINANT'S TV RECEIVER ANTENNA TERMINALS
(IN dBuV ACROSS 300 OHMS)

ALL TV CHANNELS 2 THRU 13 OBSERVED
EXPERIENCING INTERFERENCE

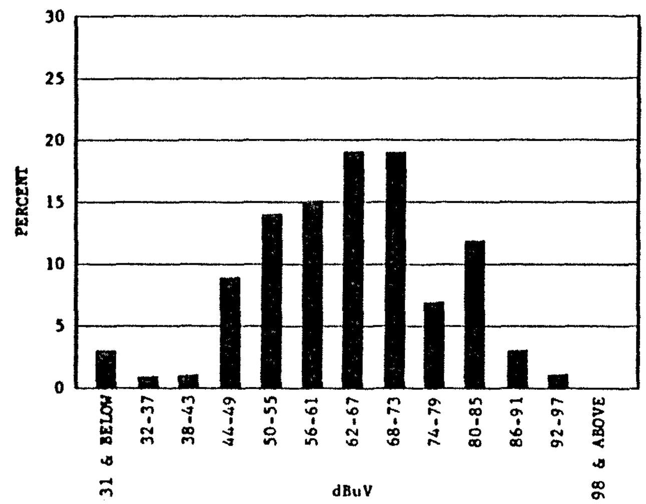


K7

GRAPH K7

TV STATION SIGNAL LEVELS MEASURED AT
COMPLAINANT'S TV RECEIVER ANTENNA TERMINALS
(IN dBuV ACROSS 300 OHMS)

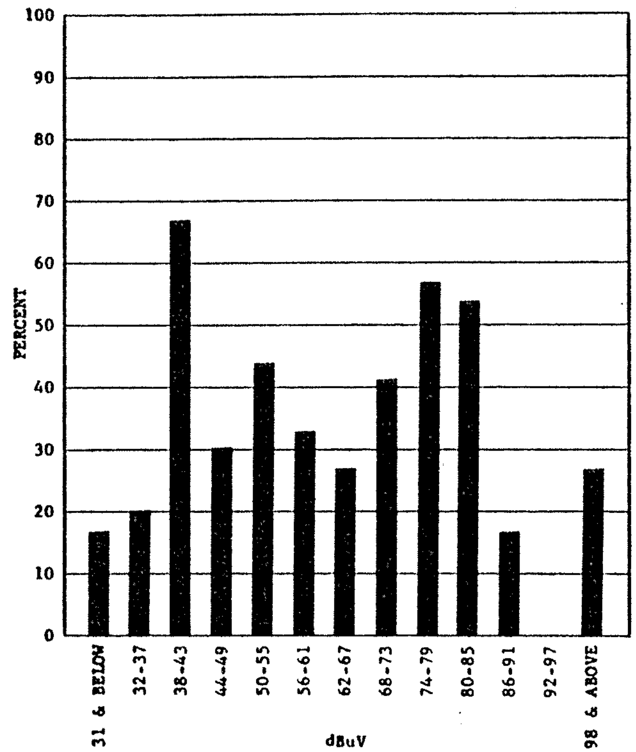
ALL 2 AND 5 TV CHANNELS OBSERVED
EXPERIENCING INTERFERENCE



GRAPH K8

LIKELIHOOD OF INTERFERENCE AS A FUNCTION OF
TV SIGNAL LEVEL AT RECEIVER TERMINALS

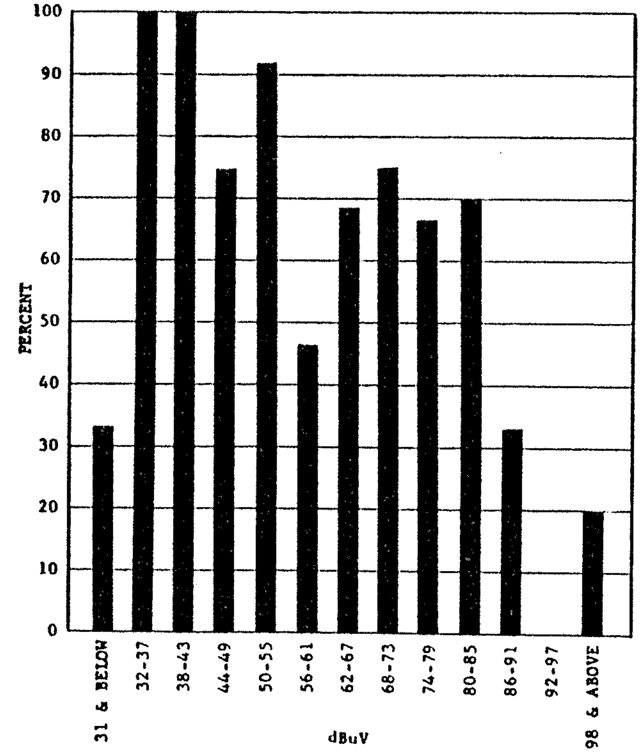
(PERCENTAGE OF CASES IN EACH TV SIGNAL RANGE
THAT WERE EXPERIENCING INTERFERENCE)
(IN dBuV ACROSS 300 OHMS)



GRAPH K9

LIKELIHOOD OF INTERFERENCE ON TV CHANNELS 2 AND 5 AS A
FUNCTION OF TV SIGNAL LEVEL AT RECEIVER TERMINALS

(PERCENTAGE OF CASES IN EACH TV SIGNAL RANGE
THAT WERE EXPERIENCING INTERFERENCE)
(IN dBuV ACROSS 300 OHMS)



APPENDIX L

TRANSMITTER AND LINEAR AMPLIFIER POWERS

The output power of each CB transmitter was measured and the findings are illustrated on Graph L1. The mean value of all transmitter power measurements was 3.6 watts with a range of 1.1 watts to 13 watts. Also, note that 19 percent of the units exceeded the maximum authorized value of 4 watts.

The output power of observed linear amplifiers was similarly measured and the findings are illustrated in Graph L2. For linears the mean output power value was 117 watts with a range of 25 watts to 400 watts.

Because antenna gain is such a significant factor in determining the stations effective radiated power (ERP), calculations of antenna gain were made using nominal values supplied by the manufacturers. The results were as follows:

Antenna Gain - All stations (mean value) = 6.1 dB.

All stations utilizing a linear amplifier (mean value) = 7.8 dB.

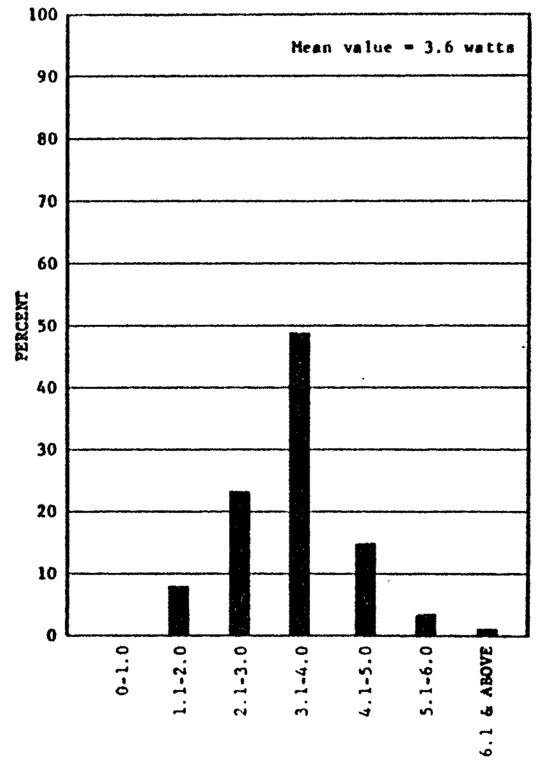
All stations not utilizing a linear amplifier (mean value) = 4.5 dB.

If ERP is calculated for the average station (neglecting line and matching loss) based on the mean values determined, the ERP of the average station operating without a linear amplifier is 10 watts and for the average station operating with a linear amplifier is 700 watts.

Finally, of the stations operating without a linear amplifier, 36 percent employed a high-gain directional antenna. While of the stations operating with a linear amplifier, 52 percent employed a high-gain directional antenna.

GRAPH L1

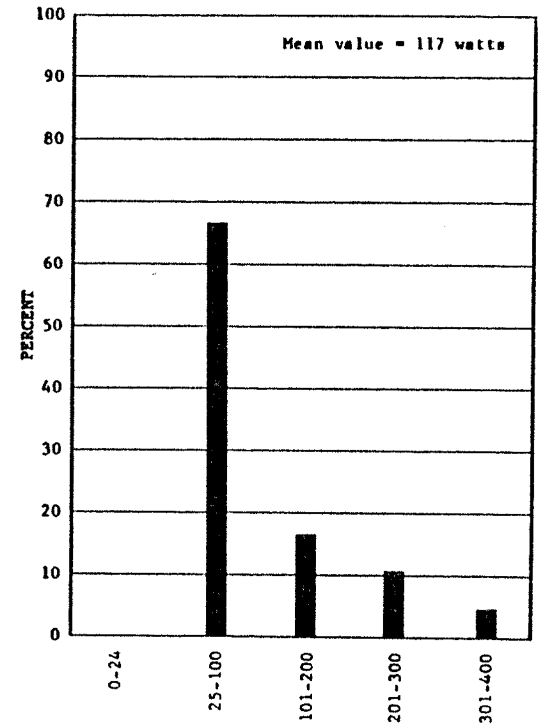
DISTRIBUTION OF CB TRANSMITTER OUTPUT POWER IN TV-CB INTERFERENCE CASES



GRAPH L2

DISTRIBUTION OF LINEAR AMPLIFIER OUTPUT POWER IN TV-CB INTERFERENCE CASES

(SAMPLE SIZE = 18)



APPENDIX M

UNANNOUNCED CB MONITORING

A recurring proposal for resolution of TV-CB interference complaints is the rigid enforcement of existing regulations. The argument advanced is that FCC personnel, through unannounced off-the-air monitoring of each CB station involved in a TV interference complaint, should detect the improper CB operation that is causing or contributing to the complaint. In the sense used here "causing or contributing" includes operating violations by the CB operator ranging from items totally unrelated to actual TV interference production, such as failure to identify by call sign, to items closely associated with TV interference, such as high power operation.

To determine the feasibility of detecting such violations, unannounced monitoring of each subject's station was conducted for four hours on each of five separate days or until the subject station became active. Violations were grouped into two categories: use of linear amplifier; and any Part 95 violation, including linear. The unannounced monitoring produced findings as follows:

72 stations monitored;

52 (72%) stations were observed in operation;

13 (18% of the 72 stations monitored or 25% of the 52 stations observed in operation) stations were observed operating a linear amplifier.[1/] Note that on-site inspections showed linears were actually associated with 46% of all cases;

23 (66% of stations observed in operation and rated)[2/] were observed in violation of some Part 95 regulation;[3/] and

12 (34% of stations observed in operation and rated) were not observed in violation of any Part 95 regulation.

1/ Note that this represents 39% of the 33 stations that actually used a linear amplifier as revealed by on-scene inspection. See Appendix L.

2/ Although 52 stations were observed in operation, the field reports only provided this data for 35 of the stations.

3/ The majority of these violations were for failure to identify by assigned call sign.

APPENDIX N

AUDIO RECTIFICATION AND OTHER AUDIO INTERFERENCE

CB radio transmissions can appear as audio signals out of a television receiver. Two of the ways CB audio can be generated are through a spurious or harmonic emission of the CB signal inserted at rf level into the audio portion of the TV signal (other audio interference) or by rectification of the CB signal in some nonlinear device in the audio portion of the TV receiver (audio rectification). This study provides brief data relating to both of these audio problems.

Audio rectification was observed on the complainant's receiver in eight percent of the cases. No audio rectification was observed on the FCC receivers and there was no concentration of this interference with linear amplifier use.

Other audio interference as defined above occurred in 19 percent of the cases. It was predominantly on TV channel 5 with a few instances on TV channels 2, 4 or 9. Fifty-eight percent of the other audio interference cases were manifest on both the FCC TV receiver and the complainant's TV receiver.

APPENDIX O

TV ANTENNA SYSTEMS

Television reception quality is largely determined by the signal supplied by the receiving antenna system. To produce an acceptable picture some minimum signal level must be supplied. This survey provides an abbreviated overview of the complainant's receiving antenna system.

Receiving antenna types were as follows:

Roof antennas	- 49%
Indoor antennas	- 44% 1/
Attic antennas	- 4%
No formal antenna	- 3%

Receiving antenna transmission lines were as follows:

300-ohm twinlead	- 78%
72-ohm coax	- 18%
Lamp cord	- 4%

A high-pass filter was found to be installed in eight percent of the antenna receiving systems.

In an effort to determine the adequacy or quality of the complainant's antenna systems, two factors were considered. First, if the received picture were at least a TASO 3 on the FCC TV, the antenna system was rated adequate. Second, if the received

1/ This figure consists of 8% monopole and 36% rabbit ears.

picture were less than TASO 3 but the contour grade as measured off the FCC antenna was equal or less than the signal level of the equivalent received contour grade off the complainant's antenna system, then the antenna system was rated adequate.[2/] Briefly, if the TV picture were acceptable or the receiving antenna performed in an average manner, the antenna system was judged adequate. Note that every viewable TV channel had to meet the tests for the antenna to receive an adequate rating. Using the above criteria, 94 percent[3/] of the receiving antenna systems were adequate.

2/ This only refers to the adequacy of the TV antenna and not the adequacy of the TV signal available. See Appendix K for discussion of signal levels of equivalent contour grades.

3/ The true value may have been 85-90%; however, lack of measurement data prevent verification.

APPENDIX P

EXTERNALLY GENERATED HARMONICS

Harmonic radiation can be generated in a nonlinear device external to both the CB transmitter or TV receiver. This study did not attempt to trace the actual source of any observed externally generated harmonic radiation. Rather, its presence and effect was simply noted.

Six percent of the cases surveyed exhibited interference attributed to an externally generated harmonic. When such interference occurred it was on TV channels 2, 5 or 9 and of rather mild severity, i.e., one TASO grade. It is believed that most of these problems were generated in a transmitting or receiving antenna system.

APPENDIX Q

TV RECEIVER ANTENNA BOOSTER AMPLIFIERS

Broadband TV receiving antenna booster amplifiers employ active elements capable of generating spurious signals when subjected to strong rf fields. The extent to which these boosters contribute to the total TV-CB interference picture has apparently never been determined. This study reviewed the impact in brief outline. However, as the boosters are normally installed at the antenna, they are not readily accessible and conducive to study.

A receiving antenna booster amplifier was installed in seven of the seventy-two complaint receiving systems surveyed. However, this study was conducted largely in grade A and B contour areas while antenna booster amplifiers are used in fringe areas. Only one of the seven cases was experiencing interference that was attributed to overload of the booster amplifier. A summary of the seven cases follows:

Case	Interference Classification
5-2026	No interference. Linear suspected but not tested.
6-3206	Transmitter harmonic chassis radiation.
4-2466	Receiver overload. FCC receiver not affected.
5-0327	Audio rectification. FCC receiver not affected.
2-3206	Receiving antenna booster amplifier overload.
4-0327	Receiver overload. FCC receiver not affected.
4-0467	Audio rectification. FCC receiver not affected.

APPENDIX R

POWER MIKES[1/]

When a power mike was found installed as part of the CB transmitting equipment, the inspecting engineer experimented with various gain settings to determine any effect on observed television interference. Seventy-five percent of the stations was using a power mike.

The comments submitted or tests performed were not standardized enough to permit thorough comparisons. Therefore, it can only be stated that high gain levels on the power mikes often caused problems in two areas: (1) overmodulation; and (2) increased spurious and harmonic emissions. However, the power mikes, while possibly causing interference to other CB stations, did not appear to have any significant impact on television interference.

1/ Microphones with built-in electronic amplification.

APPENDIX S

CB CHANNEL IMPACT

Each viewable TV channel was rated on the TASO scale with the subject's transmitter operated on three separate CB channels. One of the tested CB channels was from the low end of the band (26.965-27.055 MHz), one from the middle portion of the band (27.065-27.135 MHz), and one from the high end of the band (27.155-27.255 MHz).[1/] The tested CB channels were placed in one of the three frequency groups and no further refinement made.

Graphs S1 through S6 illustrate the probability of TV video interference occurring on each TV channel as a function of the CB channel being used. A variation of interference was noted for TV channels 2, 4, 5, 7 and 9, while no variation of interference was observed on TV channels 3, 6, 8, 10, 11, 12 and 13.

As expected, interference to TV channel 2 is most susceptible to variations of the CB operating channel. The second harmonic of the first 23 CB channels extends from 53.93-54.51 MHz and TV channel 2 extends from 54-60 MHz. TV channel 5 is the second most susceptible TV channel. The third harmonic of the first 23 CB channels extends from 80.895-81.765 MHz and channel 5 extends from 76-82 MHz. Many

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1/ When this study was implemented, only 23 CB channels (26.965-27.255 MHz) had been assigned. This number was later increased to 40 channels (26.965-27.405 MHz) but the additional 17 channels were not considered in this study.

factors determine what interfering frequency at what level will cause interference. However, a detailed discussion of these factors is beyond the scope of this study and the reader is referred to other sources. 2/3/

2/ Gene Walding, "Spectrum Pollution and the Set Top Converter," TV Communications, (July, 1971), p. 143

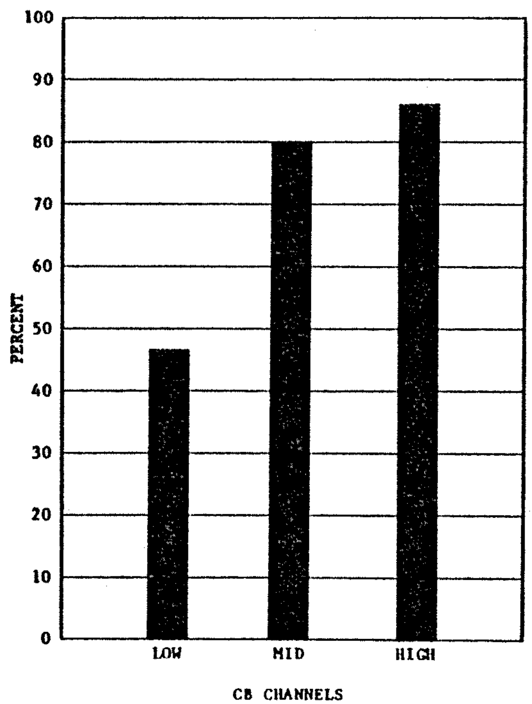
3/ Gary S. Kalagian, A Review of the Technical Planning Factors for VHF Television Service, (Washington, March, 1977).

GRAPH S1

RELATIVE PROBABILITY OF INTERFERENCE ON A GIVEN TV CHANNEL AS A FUNCTION OF A GIVEN CB CHANNEL

TV CHANNEL 2

(SAMPLE SIZE = 20)

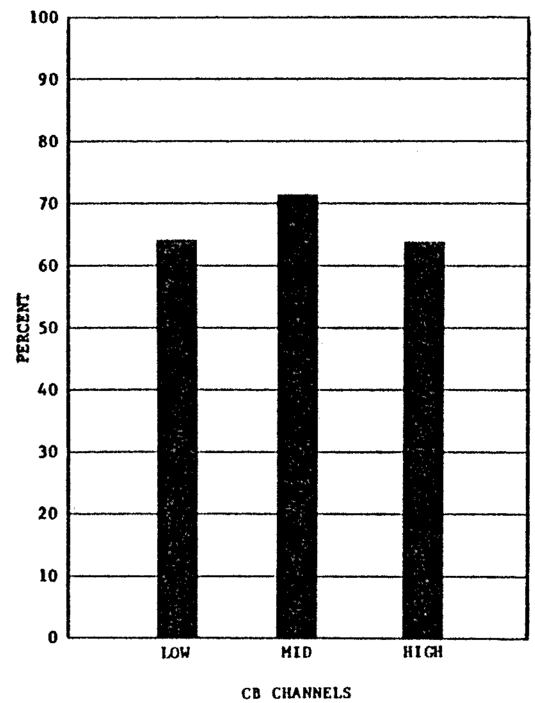


GRAPH S2

RELATIVE PROBABILITY OF INTERFERENCE ON A GIVEN TV CHANNEL AS A FUNCTION OF A GIVEN CB CHANNEL

TV CHANNEL 4

(SAMPLE SIZE = 14)

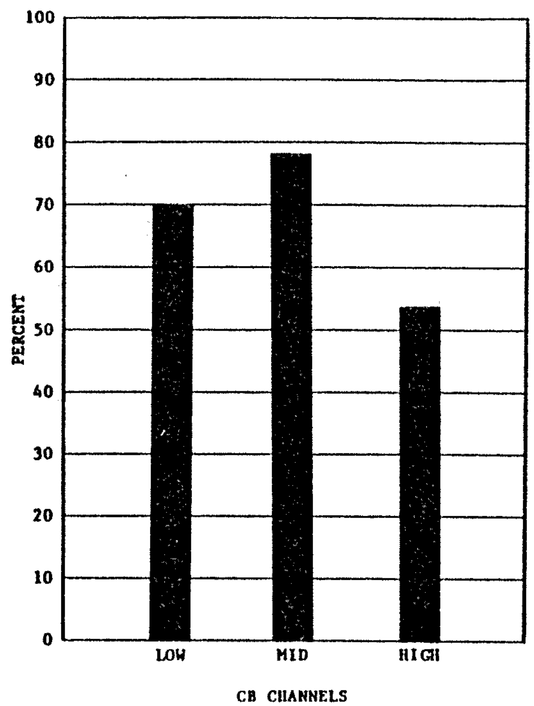


GRAPH S3

RELATIVE PROBABILITY OF INTERFERENCE ON A GIVEN TV CHANNEL AS A FUNCTION OF A GIVEN CB CHANNEL

TV CHANNEL 5

(SAMPLE SIZE = 37)

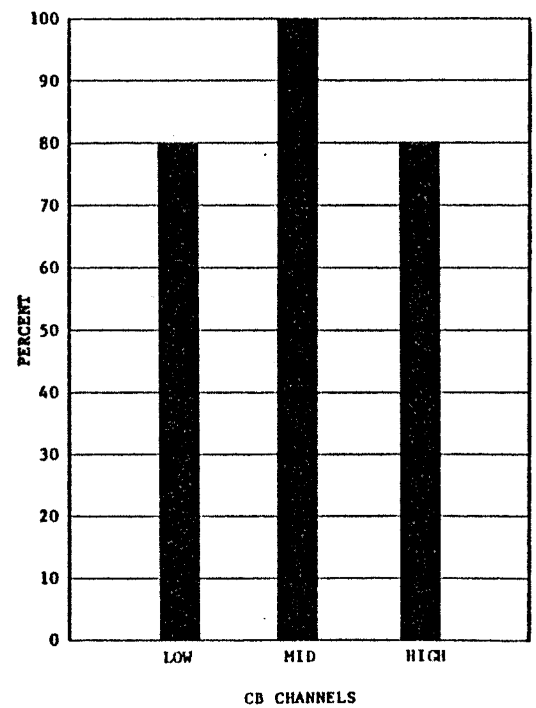


GRAPH S4

RELATIVE PROBABILITY OF INTERFERENCE ON A GIVEN TV CHANNEL AS A FUNCTION OF A GIVEN CB CHANNEL

TV CHANNEL 7

(SAMPLE SIZE = 5)

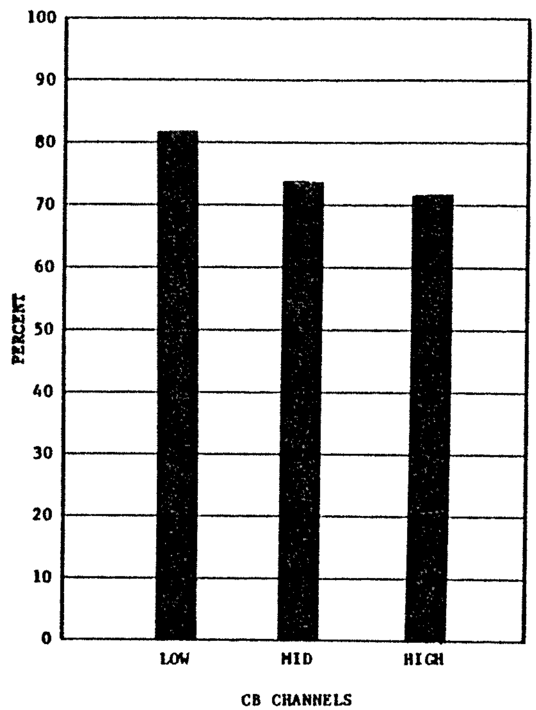


GRAPH S5

RELATIVE PROBABILITY OF INTERFERENCE ON A GIVEN TV CHANNEL AS A FUNCTION OF A GIVEN CB CHANNEL

TV CHANNEL 9

(SAMPLE SIZE = 19)

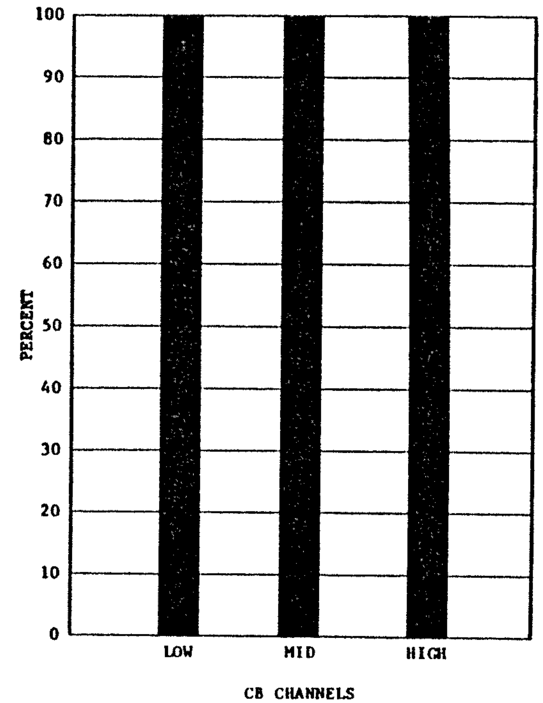


GRAPH S6

RELATIVE PROBABILITY OF INTERFERENCE ON A GIVEN TV CHANNEL AS A FUNCTION OF A GIVEN CB CHANNEL

TV CHANNELS 3-6-8-10-11-12-13

(SAMPLE SIZE = 33)



APPENDIX T

LISTING OF COMPLAINANTS' TV RECEIVERS

The make, model and age of the complainant's television receivers are listed below to the extent they were determined. Also, each case exhibiting interference attributed to receiver overload is indicated.

Case No.	Make	Model	Approximate Age	Interference Attributed to Receiver 1/ Overload
6-2896	Admiral	5L5253	4	
6-3066	"	---	6	
3-2466	GE	M920EWD	6	
3-3066	"	5G5P	2	
4-0177	"	---	4	Yes
2-0177	"	M934YM9	4	
4-0327	"	---	6	Yes
4-0467	"	---	1	
3-3506	Heathkit	565	2	
5-0177	"	GR900	2	Yes
2-0627	"	GR295	4	
4-2176	Magnavox	---	5	
5-2466	"	1C7586	3	
2-2606	"	CE4786PE62	1	Yes
5-0327	"	CE4757	2	
6-1087	"	Videomatic	1	

1/ Overload is influenced by factors external to the TV receiver, such as TV signal level.

Case No.	Make	Model	Approximate Age	Interference Attributed to Receiver Overload
3-2026	Motorola	C23TS-915-020	7	
4-2316	"	---	6	Yes
1-3506	"	Quasar QS3000	0.5	
3-0037	"	Quasar QS3000	0.1	Yes
4-3366	"	---	7	Yes
6-0467	"	Quasar KE68971A07 FE85214	12	
2-1087	"	Quasar WV91841W	2	Yes
1-0177	Packard-Bell	5CT853CL	4	
2-3206	Panasonic	CT-250	2	
6-0627	"	CT-704	2	Yes
1-0327	Philco	(Tag Removed)	8	
2-2316	RCA	(Not Visible)	10	
3-2316	"	FJ573F	5	
5-2316	"	BS405W	2	
4-2606	"	---	8	
2-2756	"	GJ627L	10	
4-2756	"	Vista	5	
3-2896	"	XL-100	1	
4-3066	"	Vista	7	
4-2466	"	---	6	

Case No.	Make	Model	Approximate Age	Interference Attributed to Receiver Overload
5-0037	RCA	RVB-7042	5	
5-3206	"	New Vista	-	
6-3506	"	XL-100	3	
2-0037	"	XL-100	3	
3-6177	"	Not Available	4	
6-0327	"	XL-100	3	
3-0627	"	XL-100	5	
4-0627	"	Vista	5	Yes
6-0767	"	XL-100	1	
4-0037	Sanyo	---	0.1	Yes
6-2026	Sears	528.50401212	3	
4-3206	"	---	2	Yes
6-0177	"	564.50020200	5	
3-0327	"	4120	10	Yes
6-2176	Sony	Trinitron KV121011	7	
4-2896	"	Trinitron	2	
2-0327	Sylvania	CF533W	8	
3-0467	"	GT Matic	2	Yes
3-2756	Teledyne	2C954W	5	
1-6037	Wards	GA1-12643A	4	
3-0767	"	GC117450B	6	
2-2026	Zenith	G2736	10	

Case No.	Make	Model	Approximate Age	Interference Attributed to Receiver Overload
5-2026	Zenith	Z-4518-1	6	
6-2316	"	Z6208	7	
2-2466	"	HT1978W	0.3	
6-2466	"	G4748DE	0.5	
3-2606	"	8308-6	12	
5-2756	"	G4748P	1	
3-3206	"	T2836-2	3	
6-3206	"	Unknown	5	
3-3366	"	Chromacolor II	1.5	
1-3366	"	T2853-DE/ 20CC50	5	
5-3366	"	---	5	Yes
5-0917	"	E4025W	4	Yes
5-1237	"	Chromacolor	3	Yes
2-0467	"	B4030	8	Yes

APPENDIX U

LISTING OF SUBJECTS' CB TRANSMITTERS

The make and FCC type acceptance number of each transmitter and linear amplifier (make only) tested is listed below to the extent they were determined. Also, each case exhibiting interference attributed to harmonic antenna or chassis radiation is indicated.

Case No.	Transmitter Make	Type Acceptance or Model No.	Amplifier Make	Harmonic Antenna or Chassis Radiation Interference Present
3-2316	Browning	GE111S	Browning	
3-2756	Cobra	139A		
2-0177	Cobra	135		Yes
4-0327	Cobra	19		
3-2026	Courier	23		
6-2466	Craig	4103		Yes
2-2026	Dynascan	89A		Yes
4-0177	Dynascan	29A		
6-1087	Dynascan	139A	Pride	
5-2466	E.F. Johnson	2420123		Yes
6-3506	Gonset	G76		
5-2316	Hy-Gain	623	Palomar	Yes
6-0327	Hy-Gain	2681		
6-2316	J.C. Penney	9816235		

Case No.	Transmitter Make	Type Acceptance or Model No.	Amplifier Make	Harmonic Antenna or Chassis Radiation Interference Present
2-3206	Kris, Inc.	23+		
4-0037	Lafayette	SSB100		
3-0177	Lafayette	COMST25B	Siltronics	Yes
3-0467	Lafayette	HB44425		
6-2176	Midland	13863B	Palomar	
5-2756	Midland	13-882B		
4-2466	Midland	13876	Hy-Gain	
4-3206	Midland	13898B		
5-0037	Midland	13873	Dartz	Yes
3-0327	Midland	13882C		
4-0467	Midland	77882		
5-0917	Midland	13-852		Yes
2-0627	Midland	13863B		Yes
2-2756	Motorola	CC1122		Yes
4-2896	Pace	42121	Palomar	
1-3506	Pace	421-21		Yes
1-0177	Pace	1023B		
3-2896	Palomar	21		Yes
3-3066	Pearce-Simpson, Inc.	Bengal	Black	Yes
3-0037	Pearce-Simpson, Inc.	GUAR23		

Case No.	Transmitter Make	Type Acceptance or Model No.	Amplifier Make	Harmonic Antenna or Chassis Radiation Interference Present
4-3366	Pearce-Simpson, Inc.	SIMBA SSB		
3-0767	President	Washington 1/	Palomar	Yes
6-2026	Realistic	21151	Pride	Yes
2-2316	Realistic	21-143		Yes
6-3066	Realistic	21143		Yes
3-3366	Realistic	21151	J. B. Associates	Yes
2-2606	Realistic	21-150		Yes
5-3206	Realistic	TRC30A	Fist	Yes
2-0327	Realistic	21-153		Yes
4-0627	Realistic	21-157		
2-1087	Realistic	21-143		
4-3066	Regency	CR142	Apollo	
3-3206	Regency	LR142AM		Yes
3-0627	Robyn	8M74T123		
4-2176	Royce	200-631	Hy-Gain	
3-2466	Royce	201602		Yes
6-2896	Royce	1-653B		Yes
6-3206	Royce	200600A		Yes
1-3366	Royce	200624		
3-3506	Royce	200620		

1/ This was the only unit tested that was type accepted under the new 60-dB suppression requirements.

Case No.	Transmitter Make	Type Acceptance or Model No.	Amplifier Make	Harmonic Antenna or Chassis Radiation Interference Present
1-0037	Royce	601		
5-1237	Royce	200620		Yes
5-2026	SBE	12CB/T		
2-2466	SBE	16CB/T	Afterburner	Yes
5-3366	SBE	VOID		Yes
6-0177	SBE	---		
6-0627	SBE	16CBT		
6-0767	SBE	8CB	Palomar	Yes
1-0327	SBE	Console II		Yes
5-0177	Sears	23934		
5-0327	Sears	---		
2-0037	Sears	613674		Yes
4-2316	Surveyor	2300		
3-2606	Teaberry	TB1400	Palomar	Yes
4-2756	Teaberry	T-Control	Elkins	
6-0467	Teaberry	T-Scout		
4-2606	Tram	D201	Varmit	
2-0467	Yaesu	FT-101EE		Yes

APPENDIX V

DESCRIPTION OF PRESENT FOB CB-TV COMPLAINT RESOLUTION PROCEDURES

For many years, cases involving interference to television reception were handled by individual, on-the-scene investigations. As the popularity of television and two-way radio equipment in the home blossomed, the number of interference complaints to be handled by the FCC mushroomed. By the mid-1960's, the complaints of television interference were too numerous to permit individual investigations, so most complaints were handled by correspondence.

Answering each complaint with a personalized letter soon became an impossible task, promoting the development of form letters and printed information bulletins. The entire complaint procedure became one of self-help on the part of the complainant. The bulletins provided some information which the complainant could use to help add filtering to the equipment. Often the self-help approach was very effective and eliminated the interference problem.

In cases where the complainant followed the recommended procedures and still received interference, the FCC would contact the offending radio operator and require that this equipment be checked for proper operation.

As a last resort, an on-the-scene investigation would be made by FCC personnel.

The Commission has recently reviewed the quality of the printed material available to the public and has revised and condensed the information into a new booklet, entitled "How To Identify & Resolve Radio-TV Interference Problems." Although the booklet must be purchased from the Government Printing Office, the FCC is hopeful that it will receive wide circulation and be helpful to thousands of TV viewers, TV and CB service technicians, and radio station operators finding themselves in the TV interference conflict.

APPENDIX W

TECHNICAL SURVEY PROCEDURES

Field offices participating in this survey were instructed as to expected performance via written correspondence dated January 20, 1976, and subsequent memoranda and conference telephone conversations. The instructions were essentially as outlined below.

Introduction

The following program was designed to further identify procedures and options available to the Commission for handling interference complaints involving television reception versus CB radio transmission. It was anticipated the collected data would allow selection of more effective options for resolving such complaints. Each field investigation was to be very comprehensive and result in "hard" statistical data.

Participation

The Commission's Buffalo, Baltimore,[1/] Kansas City, Norfolk, San Francisco, and Seattle District Offices were assigned to participate in this program. Each office was expected to conduct two field investigations per month until a total of 72 cases was completed. It was felt this was a number that could be handled and yield useful information on the complainant's problems.

1/ Denver was initially selected to participate in this study in lieu of Baltimore. However, because of personnel and other workload limitations, Baltimore was later substituted.

Field investigations were initially to begin in February and continue through July 1976. However, equipment deliveries and other problems delayed the starting date until August 1976.

Random Selection of Complaints

See Appendix Y.

Special Forms and Equipment

(A) Each participating office was supplied:

Spectrum Analyzer

Field strength meter with a 20-200 MHz biconical antenna.

30 dB 500-watt 50-ohm attenuator
20 dB 25-watt 50-ohm attenuator
300-ohm to 50-ohm balun
72-ohm to 50-ohm balun

30-minute TASO grading course on one-half inch reel-to-reel video tape;

Subject Profile forms;[2/]

Complainant Profile forms;[3/] and

Neighborhood Survey forms.[4/]

(B) Each participating office obtained locally:

Material or components necessary to TVI proof the FCC television receiver;[5/]

Low-pass filter for transmitter (Drake TV-3300-LP); and

High-pass filter for receiver (Drake TV-300-HP).

2/ See p. W14.

3/ See p. W16.

4/ See Appendix Z.

5/ See Appendix X.

Extent of Investigation

The actual on-site investigation consisted of four parts: (a) unannounced monitoring; (b) CB equipment measurements; (c) TV interference analysis; and (d) a neighborhood survey. Appropriate forms were provided for recording pertinent data. The primary objective was to obtain statistical data and not to generate production statistics by issuing violation notices to the station licensee when defects were detected. Therefore, to encourage maximum cooperation during the survey, noted discrepancies were verbally discussed with the station operator but no Official Notice of Violation was issued unless the operator refused to have a noted deficiency corrected.

(A) Unannounced Monitoring - Prior to any communication with the subject (station operator) unannounced monitoring was conducted to determine compliance with operating rules such as station identification, out-of-band operation and time restrictions. Also, to check for overpower operation, one or more close-in monitoring points (approximately 150 to 500 feet distant) were calibrated for the station's relative field strength. When a directional transmitting antenna was used, the antenna's orientation was noted and monitoring points were selected in the major lobe. Results were recorded on the Subject Profile Part I form.

The unannounced monitoring continued for a minimum of four hours on each of five separate days or until the subject was observed on-the-air, whichever occurred first. If no activity were observed after this time, the subject Profile Part I form was so noted and the engineer proceeded with the inquiry.

(B) CB Equipment Measurements - The station operator's permission was sought to conduct a series of tests. If the operator refused to permit inspection, an Official Notice of Violation was issued. If permission were granted, the initial test was to reproduce the relative field strength values noted during the unannounced monitoring. Reproduced values were expected to be within one or two dB of the initial values. Any significant deviation was explained. If a power amplifier were suspected but not observed in operation, the engineer tried to persuade the subject to produce it for tests.

Using an appropriate wattmeter, the transmitter and amplifier power output were measured. Similarly, with an appropriate meter, the antenna line s.w.r. for both transmitter and amplifier were measured. The readings were recorded on the Subject Profile form.

For the harmonic/spurious output analysis (Subject Profile Part II form) the interest was in direct antenna radiation, indirect "chassis" radiation and externally generated signals. The requested readings were self-explanatory. If, through the measurements, an external mix were suspected, the engineer tried to isolate the cause.

A column explanation of the Harmonic/Spurious Output Analysis measurements as listed on Subject Profile Part II form follows:

(1) In-Line, Xmtr Line - With the subject's transmitter connected to the spectrum analyzer, through attenuators, harmonic/spurious values were measured and recorded.

(2) In-Line, Amp Line - With the subject's power amplifier connected to the spectrum analyzer, through attenuators, harmonic/spurious values were measured and recorded.

(3) In-Line, Xmtr and Lo-Pass - A low-pass filter was installed in the transmitter output line and harmonic/spurious values measured and recorded. A direct connection, through attenuators, to the spectrum analyzer was used.

(4) In-Line, Amp and Lo-Pass - A low-pass filter was installed in the power amplifier output line and harmonic/spurious values were measured and recorded. A direct connection, through attenuators, to the spectrum analyzer was used.

(5) Direct Pickup, No Filter, No Attn. - One set of measurements was conducted as close to the transmitter as possible (within the house) and a second

set at 50-100 feet. The spectrum analyzer and the Singer biconical antenna were used to measure the fundamental and harmonic/spurious emissions of the subject's transmitter as observed off-the-air. No filter or attenuator was used in the transmitter line.

(6) Direct Pickup, Filter, No Attn. - One set of measurements was conducted as close to the transmitter as possible (within the house) and a second set at 50-100 feet. The spectrum analyzer and the Singer biconical antenna were used to measure the fundamental and harmonic/spurious emissions of the subject's transmitter as observed off-the-air. A low-pass filter was used in the transmitter line.

(7) Direct Pickup, Filter, Attn. - One set of measurements was conducted as close to the transmitter as possible (within the house) and a second set at 50-100 feet. The spectrum analyzer and Singer biconical antenna were used to measure the fundamental and harmonic/spurious emissions of the subject's transmitter as observed off-the-air. A low-pass filter in line with a dummy antenna or in lieu of the dummy antenna at least 50-dB attenuation were used in the transmitter line.

(C) TV Interference Analysis - The information requested on the Complainant Profile Part I form was completed as thoroughly as possible. For "multiple" complaint cases one complainant was selected for the tests--preferably the principal complainant. With the complainant's permission, a series of tests was conducted utilizing the complainant's principal television receiver and principal television antenna system. The tests were listed on the Complainant Profile Part II form. A separate form was completed for the subject's transmitter and the subject's transmitter and power amplifier. Following is a column-by-column explanation:

(1) TV CH - Television Channel number

(2) TV GD - Predicted TV signal grade: City, A, B, Not Served (N.S.). Data obtained from Commission records.

(3) CB CH - CB radio channel. Three CB channels were listed for testing, one low, one middle and one high.

(4) TASO, No CB, Comp. - TASO grade of reception on complainant's TV receiver with CB equipment not active. All received TV channels were graded.

(5) TASO- No CB, FCC - TASO grade of reception on FCC receiver connected to complainant's antenna with CB equipment not active. All received TV channels were graded.

(6) TASO, with CB, Comp. - TASO grade of reception on complainant's TV receiver with CB equipment active. Tests were made on three separate CB channels.

(7) TASO, with CB, FCC - TASO grade of reception on FCC receiver connected to complainant's antenna with CB equipment active. Tests were made on three separate CB channels.

(8) TASO, with CB, with Lo-Pass, Comp. - A low-pass filter was inserted in the subject's transmission line, and the tests outlined in item C-6 above were made.

(9) TASO, with CB, with Lo Pass, FCC - A low-pass filter was inserted in subject's transmission line, and the tests outlined in item C-7 above were made.

(10) TASO, with CB, with Attn., FCC - A dummy load or at least 50 dB of attenuation was inserted in subject's transmission line, and tests outlined in item C-7 above were made.

(11) TASO, with CB, with Lo-Pass, with Hi-Pass, Comp. - A low-pass filter was inserted in subject's transmission line, and a high-pass filter was inserted in complainant's antenna lead. The tests outlined in item C-6 above were made.

(12) F.S. Off TV Ant., CB - Using an appropriate matching balun and attenuator, the spectrum analyzer was connected to the complainant's TV antenna lead, and the fundamental and harmonic signal levels of the CB station read.

(13) F.S. Off TV Ant., TV - Using an appropriate matching balun and attenuator, the spectrum analyzer was connected to the complainant's TV antenna lead, and the signal levels of each TV station read.

(14) F.S. Direct, CB - The biconical antenna (from Singer NM 37/57 field strength meter) and appropriate attenuator were connected to the spectrum analyzer, and the field strength of the CB station in front of the complainant's residence and as near to the complainant's TV antenna as possible was read. Any directional transmitting antenna was oriented for maximum received signal.

(15) F.S. Direct, TV - The biconical antenna (from Singer NM 37/57 field strength meter) was connected to the spectrum analyzer, and the field strength of each received TV station was measured in front of the complainant's residence.

In order to obtain information on audio and "color fade" interference, a special code was listed for providing such data. Normally the TASO recorded values only apply to video degradation. However, if audio interference were noted, a double entry was made and keyed as follows: video grade/audio grade. The same 1 to 6 grading scale was used for the audio interference.

If "color fade" was the only video degradation noted, an "*" or "$\triangle$" was recorded in the TASO grade column: "*" to indicate mild color fade and "$\triangle$" to indicate severe color fade.

(D) Neighborhood Survey - See Appendix Z.

Measurement Procedures

(A) Relative Field Strength of CB station - The spectrum analyzer was connected to a short whip antenna on the FCC car. Two or 3 locations approximately 150 to 700 feet from the CB transmitting antenna were selected. If a directional transmitting antenna were employed, calibration locations were selected in the major lobe of radiation. Readings produced on the spectrum analyzer by the CB station were noted. If all parameters were reinstituted during subsequent inspection, the engineers were to reproduce the original signal within one or two dB. This technique was only used for the purpose of this study.

(B) "In-Line" Harmonic/Spurious Measurements - The transmitter output was connected in series to the 30-dB 500-watt attenuator and spectrum analyzer input as outlined below. The attenuators and spectrum analyzer replaced the antenna.

Xmtr → 30 dB → 20 dB → Spec Anl

The above technique (50-dB attenuation) will produce a signal of less than 1 volt at the spectrum analyzer input for up to a 500-watt transmitter.

(C) Direct Pickup Harmonic/Spurious and Field Strength Measurements - The biconical antenna (from the Singer NM 37/57 field strength meter) was connected to the spectrum analyzer. As necessary, a 20 dB attenuator was included in the line to protect the spectrum analyzer's 1-volt maximum input. The values were read in dB, and the appropriate biconical antenna correction values were added.

(D) TASO Grading - A reel-to-reel, one-half inch, 30-minute video tape was furnished for TASO training. Each participating engineer reviewed the tape and became familiar with the six levels of interference. The following definitions apply.

TASO GRADATIONS

Number	Name	Description
1	Excellent	The picture is of extremely high quality, as good as you could desire.
2	Fine	The picture is of high quality, providing enjoyable viewing. Interference is perceptible.
3	Passable	The picture is of acceptable quality. Interference is not objectionable.
4	Marginal	The picture is poor in quality, and you wish you could improve it. Interference is somewhat objectionable.
5	Inferior	The picture is very poor but you could watch it. Definitely objectionable interference is present.
6	Unusable	The picture is so bad that you could not watch it.

Reporting

On completion of each investigation, one copy of the Subject Profile, Complaint Profile and RFI Neighborhood Survey forms and covering Form FO-951 (FOB Investigative Case Report form) were submitted to Chief, Enforcement Division. The FO-951 was used for comments.

Special problems and inquiries were addressed to Enforcement Division departmental staff assigned to this study.

Prior to submitting any reports, the data were reviewed for obvious errors and inconsistencies. Reasonable additions and modifications to the data were made as appropriate. Any noted but uncorrected inconsistencies were footnoted and explained. The necessity of accuracy was emphasized. As these tests were conducted on a random statistical basis, the results should apply universally with some precision which may be determinable. The extrapolation of results based upon scientifically selected samples of small size is valid if errors are minimized.

DIST: ____________
ENGR: ____________
DATE: ____________

SUBJECT PROFILE PART I

NAME: ____________
ADDRESS: ____________
____

NUMBER OF COMPLAINTS RECEIVED AGAINST SUBJECT: ________ IN THE LAST 6 MONTH PERIOD

TRANSMITTER: MAKE ____________ MODEL: ____________
TYPE ACCEPTANCE NUMBER: ____________

ANTENNA: TYPE: ____________ GAIN ____________

LOW PASS FILTER: TYPE ____________

POWER MICROPHONE: TYPE ____________

POWER AMPLIFIER: MAKE ____________ MODEL ____________
RATED OUTPUT ____________

UNANNOUNCED MONITORING: ID ____________ TIME ____________
OTHER (SPECIFY) ____________

POWER CONSIDERATIONS:
LOC. 1: DESCRIPTION ____________
BEAM ORIENTATION ____________
REL. F.S. BEFORE INSP ____________ REL F.S. DURING INSPECTION ____________
AMP SUSPECT ____________. IF "YES" APPROX. POWER ____________

LOC. 2: DESCRIPTION ____________
BEAM ORIENTATION ____________
REL. F.S. BEFORE INSP ____________ REL F.S. DURING INSPECTION ____________
AMP SUSPECT ____________. IF "YES" APPROX. POWER ____________

MEASURED XMTR OUTPUT ____________ W MEASURED AMPLIFIER OUTPUT ________ W

MEASURED XMTR SWR ____________ MEASURED AMPLIFIER SWR ____________

SUBJECT PROFILE PART II

HARMONIC/SPURIOUS OUTPUT ANALYSIS

DIST: ____________
ENGR: ____________
DATE: ____________
SUBJECT: ____________

IN LINE (___ db attenuator):

	XMTR LINE	AMP LINE	XMTR + LO PASS	AMP + LO PASS
FUND				
2				
3				
4				
5				
spur_				
_				

DIRECT PICKUP:

MEASURED AT ________ FT

	NO FILTER NO ATTN.	FILTER NO ATTN.	FILTER ATTN.
FUND			
2			
3			
4			
5			
spur_			
_			

MEASURED AT ________ FT

	NO FILTER NO ATTN.	FILTER NO ATTN.	FILTER ATTN.
FUND			
2			
3			
4			
5			
spur_			
_			

EXTERNAL MIX:

COMMENT: ____________

POWER MICROPHONE:

COMMENT: (Any noted variations with level setting) ____________

FCC Office: ____________________
Investigator: ____________________
Date: ____________________
Subject: ____________________

COMPLAINANT PROFILE PART I

NAME:

ADDRESS:

TELEVISION: Make: ________ ☐ Black/White ☐ Color

Model/Chassis #: ________ ☐ Console ☐ Portable

Age: ________ ☐ Solid State ☐ ________ (other)

DISTANCE CB ANTENNA TO TV ANTENNA ☐ 0-50 ft. ☐ 50-200 ft. ☐ 200-500 ft.

VERTICAL DISTANCE SEPARATION ____________ **ft.** ☐ 500-1000 ft. ☐ over 1000 ft.

Approximate number of homes within the following distances of Subject's (CB operator) transmitting antenna:

_____ 0-50 ft. _____ 50-200 ft. _____ 200-500 ft. _____ 500-1000 ft.

TELEVISION ANTENNA SYSTEM:

Type antenna: ____________ Filters: ____________

Type antenna lead: ____________ Baluns: ____________

Antenna Booster: ____________

General Condition of antenna system: ☐ excellent ☐ good ☐ marginal ☐ poor

CONSTRUCTION OF HOME IN NEIGHBORHOOD (Check all appropriate boxes).

☐ Detached
☐ Row
☐ Apartment
☐ Trailer
☐ Other ____________

☐ Wood/Shingle/Masonry
☐ Aluminum
☐ Steel
☐ Steel skeleton
☐ Other ____________

☐ Residential area
☐ Business area
☐ Industrial area
☐ Rural area
☐ Other ____________

COMPLAINANT AND SUBJECT COOPERATIVE? (If no, please detail)

Steps taken by COMPLAINANT:

Steps taken by SUBJECT:

COMPLAINANT PROFILE - PART II

☐ XMTR
☐ XMTR + AMP

DIST: ____________________
ENGR: ____________________
DATE: ____________________
SUBJECT: ____________________

KEY: VIDEO/AUDIO
* MILD COLOR
Δ BAD COLOR

TV CH	TV GD	CB CH	TASO NO CB COMP	TASO NO CB FCC	TASO WITH CB COMP	TASO WITH CB FCC	TASO WITH CB WITH LO PASS COMP	TASO WITH CB WITH LO PASS FCC	TASO CB ATTN FCC	TASO CB L→HI COMP	F.S. OFF TV ANT CB	F.S. OFF TV ANT TV	F.S. DIRECT mV/m CB	F.S. DIRECT mV/m TV
2											Fund		Fund	
3														
4											2nd		2nd	
5											3rd		3rd	
6											4th		4th	
7											5th		5th	
8											spur		spur	
9											spur		spur	
10														
11														
12														
13														

APPENDIX X

TECHNICAL SURVEY TEST EQUIPMENT

The test equipment used to perform the measurements for this study is listed in Table X1. With the exception of the Commission television receivers, no modifications were made to the equipment as supplied by the manufacturer.

Each Commission television receiver was modified to decrease susceptibility to fundamental overload from a 27 MHz signal. Table X2 lists the modifications that were made to the Commission's television receivers. On completion of the study, the Laboratory Division tested the six television receivers for 27 MHz fundamental overload on theoretical worst case television channels 2, 5 and 6. Table X3 lists the results of the tests which consisted of feeding television signals at various predetermined levels and determining what level of 27 MHz signal was necessary to produce "Barely Perceptible Interference". 1/

1/ Hector J. Davis and others, Interference to Sample Television Receivers from Frequencies in the Range of 27 MHz, 223 MHz and 900 MHz (Washington, July 1977).

TABLE X1

LIST OF MEASUREMENT EQUIPMENT

	Office					
Device	Buffalo	Baltimore	Norfolk	Kansas City	San Francisco	Seattle
Spectrum Analyzer						
Tektronix 7L12/7613	x					x
Tektronix 7L13/7613			x	x		
Hewlett-Packard 8552/1415					x	
Hewlett-Packard 8553/141T		x			x	
Calibrated Antenna						
Singer Biconical 944551	x	x	x	x	x	x
Wattmeter						
Bird Thruline 43	x	x	x	x	x	x
Attenuator						
Bird 30 dB 8325	x	x	x	x	x	x
Bird 20 dB 8340	x	x	x	x	x	x
Kay 30 dB 30-0			x			
High-Pass Filter						
Drake TV-300-HP	x	x	x	x	x	x
Low-Pass Filter						
Drake TV-3300-LP	x	x	x	x		x
Barker and Williamson 425					x	
Television Receiver						
General Electric WM205HWD4	x			x	x	x
Sony KV 1212		x	x			

TABLE X2

Modifications to FCC Television Receivers

Office/Receiver	Modifications
Buffalo/ GE WM205HWD4	Drake TV-300-HP high-pass filter and Drake TV-300-FMS FM band-rejection filter installed at tuner.
Baltimore/ Sony KV1212	Drake TV-75-HP high-pass filter installed at tuner and 75-ohm lead replaced with double shielded coax.
Norfolk/ Sony KV1212	Drake TV-300-HP high-pass filter installed external.
Kansas City/ GE WM205HWD4	Drake TV-300-HP high-pass filter installed at tuner and 0.001-microfarad capacitors installed on power line.
San Francisco/ GE WM205HWD4	Drake TV-300-HP high pass filter and Drake TV-300-FMS FM band-rejection filter installed at tuner, 300-ohm lead replaced with shielded 300-ohm lead and bypass capacitors added at speaker terminals.
Seattle/ GE WM205HWD4	Drake TV-300-HP high-pass filter installed at tuner.

TABLE X3

OVERLOAD CHARACTERISTICS OF FCC TELEVISION RECEIVERS

Office/ Receiver	TV Channel	Undesired Signal Levels (dBm) for Barely Perceptible Interference — Desired Channel Levels (dBm) -66	-58	-52	-46	-26	-6
Buffalo/ GE WM205HWD4	2	- 4	- 4	+	+	+	+
	5	+	+	+	+	+	+
	6	+	+	+	+	+	+
Baltimore/ Sony KV1212	2	- 6	- 5	+	+	+	+
	5	+	+	+	+	+	+
	6	+	+	+	+	+	+
Norfolk/ Sony KV1212	2	-14	-17	-16	-12	+	+
	5	- 2	- 1	- 4	+	+	+
	6	+	+	+	+	+	+
Kansas City/ GE WM205HWD4	2	+	+	+	+	+	+
	5	+	+	+	+	+	+
	6	+	+	+	+	+	+
San Francisco/ GE WM205HWD4	2	-12	- 8	- 8	- 4	+	+
	5	+	+	+	+	+	+
	6	+	+	+	+	+	+
Seattle/ GE WM205HWD4	2	+	+	+	+	+	+
	5	+	+	+	+	+	+
	6	+	+	+	+	+	+

Notes:

For TV channel 2 the undesired signal was 27.365 MHz.
For TV channel 5 the undesired signal was 26.985 MHz.
For TV channel 6 the undesired signal was 27.405 MHz.
Undesired signals modulated 1000 Hz, 30 percent AM.
The Norfolk receiver was tested without the external high-pass filter.
(+) means that inferference was not perceived by one or both observers with the interfering signal at its maximum level of 0 dBm.

APPENDIX Y

CASE SELECTION

The study consisted of 72 cases representative of interference complaints to the Commission involving degraded television reception associated with CB radio transmissions. To obtain an unbiased sample with respect to complainants, a random selection technique was employed for each of the six field offices.

For a complaint to be considered, it had to meet each of the following criteria:

(a) Filed in writing;

(b) Identified the subject (station operator);[1/]

(c) Concerned interference to TV reception from CB transmissions;[1/] and

(d) Located within 150 miles of one of the 6 participating FCC offices.

Using the above criteria, each office maintained a chronological log[2/] started every two weeks and continued until five complaints were logged. From the compiled list a random generated Citizens Band Television Interference Case Selection Table[3/] was used to select the case to investigate each two weeks.

1/ If there were any doubt, the matter was discussed with the complainant by telephone to ascertain with near certainty.

2/ See p. Y3.

3/ See p. Y4.

The table contained a column for the office which, in turn, contained either the number "one" or "two" corresponding to a particular two-week period. If the number were "one," the first eligible case to arrive on or after that date was selected; if it were "two," the second eligible case to arrive on or after that date was selected. If no eligible cases were received between one date and the next (or if only one was received when "two" was to be investigated), then no case was investigated during that time period. All complaints not selected for investigation were processed in the normal manner.

If the selected case failed to materialize, i.e., the subject or complainant moved, or sold their equipment, the next complaint on the log after the previously selected case was selected.

OFFICE: ____________

MONTH: ____________

PAGE ___ OF ___ PAGES

CITIZENS BAND TELEVISION INTERFERENCE LOG

	Complainant		Subject	
Date Received	Name and Address	Telephone Number	Name and Address	Telephone Number

CITIZENS BAND TELEVISION INTERFERENCE

CASE SELECTION TABLE

DATE \ OFFICE	BF	NF	KC	BM	SF	ST
May 24	1	2	2	2	1	2
June 7	1	1	1	1	2	1
June 21	2	2	1	2	2	2
July 6	2	1	2	2	2	2
July 20	1	1	2	1	1	1
Aug. 4	2	1	1	1	1	1
Aug. 18	2	1	1	1	1	1
Sep. 2	1	2	1	1	2	1
Sep. 16	2	2	2	1	2	1
Oct. 1	1	2	1	2	1	2
Oct. 15	2	1	2	1	2	1

APPENDIX Z

DESCRIPTION OF THE NEIGHBORHOOD SURVEY

The following is a description of the RFI Neighborhood Survey procedures:

Method of Selection

Eight neighbors of the CB operator causing the TVI were interviewed to determine the extent of TVI in that area. The CB operator's neighborhood was divided into four concentric areas measuring 0-50, 50-200, 200-500 and 500-1000 feet. Two respondents in each area were selected by using a compass and a computer-generated list of random numbers between 001 and 360. Starting at the beginning of the list and proceeding downward, the engineers conducting the survey sighted along each radial for a dwelling to be surveyed in the appropriate ranges. If the radial did not bisect a dwelling, they proceeded in a clockwise direction if the last digit of the radial were odd and in a counterclockwise direction if the last digit were even, to the nearest dwelling in the specified distance. If the FCC personnel were unable to obtain an interview in that dwelling, they continued in the same manner until they did so.

At the conclusion of the survey, a rough sketch of the area was drawn, indicating the approximate locations of the subject, complainant(s), and respondents, relative to true north. A number was assigned to each interview and the respondents were identified accordingly. The personnel conducting the survey were also instructed to indicate the approximate direction of television stations serving the area. (See p. Z15).

Interview Instructions

The interviewer was instructed to make a specific assessment of the time of day which would be most convenient for the respondents in the area under study. Whenever possible, the interviews were conducted at that time. The interviewer, in order to avoid the possibility of being mistaken for a salesman, carried the survey materials in a folder rather than a briefcase. Upon meeting the respondent, the interviewer introduced himself by name, stated his office and presented FCC credentials for examination. The interviewer then provided a clear and brief explanation of the purpose of the survey, emphasizing the fact that the respondent's answers would be confidential, and that neither the respondent's name nor address would be identified when the results were tabulated. An appropriate explanation of the survey is contained in the first page of the survey questionnaire (see pp. Z7-Z15).

The interviewer was instructed to avoid the use of the word "investigation," as this was to be a survey and not an investigation. Furthermore, the interviewer was to take a positive attitude and say "I would like to talk with you," as questions which permitted negative responses could lead the respondent into refusing to be interviewed. For instance, consider the following question-and-answer sequences: "Are you busy now?" ("Yes, I am."); and "Should I come back later?" ("Yes, come back later.") The interview was conducted at the door, weather permitting. A female respondent was not interviewed inside the dwelling unless there were other persons present.

Each interviewer was prepared to handle difficult situations in the first stages of the interview. These situations included such responses as "I'm too busy," "Do I have to do this?" or "What good is this?" In the case of "I'm too busy," the interviewer mentioned that the interview would last only ten or so minutes. If the person persisted with this excuse, the interviewer asked if it were convenient to return to conduct the interview in 30 (or whatever) minutes. If the answer continued to be negative, the interviewer politely thanked the person and proceeded to the next dwelling.

When a respondent replied by saying, "Do I have to do this?" the interviewer was instructed to reply, "There is no legal obligation for you to take part in this survey, but we do need information from you if our results are to give an accurate picture of interference to home electronic entertainment equipment from radio transmissions in this area."

A response such as "What good is this?" was answered by pointing out the general usefulness of surveys in uncovering problems facing the public--problems such as radio frequency interference in the respondent's neighborhood. If the respondent refused to be interviewed, the interviewer offered reassurances about the legitimacy and importance of the survey. However, if the respondent were adamant, the person's request was respected. Under these circumstances, the interviewer politely left the premises and proceeded to the next dwelling.

The interviewers were given five major interviewing principles to follow:

- Ask questions exactly as they appear on the form;
- Carry only the materials necessary to conduct the interview;
- Do not use the word "investigate";
- Do not suggest answers; and
- Do not use a tape recorder.

The interviewers were warned that there would be occasions when the respondent would furnish answers which were incomplete, unclear, irrelevant, or otherwise inadequate for the purposes of the survey. In this case, the interviewers were instructed to probe the respondent for further information without suggesting answers. The specific aim of the probe was to obtain information which satisfied the purposes of the question. Skill was required in probing to resolve ambiguous statements. The challenge was to elicit correct information without appearing to be carrying on a cross-examination.

Several kinds of neutral probes were used in the survey interview. A well-timed pause was perhaps the simplest and most neutral way of stimulating further discussion by the respondent. Also, offering encouragement by such remarks as "I see," "Yes," or "That is very interesting" was combined with the silent probe. An elaboration probe consisted of neutral questions or comments used to obtain more complete or accurate responses, such as "I'm not sure I understand," "What do you think causes that?" "Could you tell me more about the interference you are receiving?" or "Anything else?" Clarification probes were in order when the responses were given in such a way that they appeared to be inconsistent, contradictory, or ambiguous. The interviewer then introduced questions such as "I'm sorry, but I'm not clear about what you meant by that--could you tell me a little more?" "I'm not sure I understand," or "About when did that occur?"

The interviewer was warned that probing was helpful only when it was neutral, and that care must be used to maintain control of probing questions, since they could easily have led to bias or distortion in the information furnished by the respondent. The FCC personnel were also instructed to avoid questions which suggested an answer or directed the respondent's attention to one alternative rather than others. For example:

Q. Can you describe the nature of the interference you are experiencing on your FM radio?

A. I can't say exactly.

Q. Well, is it a buzzing, or a loud hum, or a crackling sound? (Probe)

The above probe introduced basic changes in the content of the original question. The most appropriate probe might well have been a few moments of silence, followed by a neutral question such as "Can you associate the sound with something else?" In probing, the interviewer was admonished never to suggest a possible answer. In summary, they were instructed that probes were to be used only when responses were inadequate, and that they were to be neutral.[1/]

1/ Donald P. Warwick and Charles A. Lininger, The Sample Survey: Theory & Practice (New York, 1975).

RFI NEIGHBORHOOD SURVEY

INTERVIEW NUMBER
(Circle appropriate number)

1	5
2	6
3	7
4	8

FCC OFFICE: ______________________

INTERVIEWER: ______________________

SUBJECT: ______________________

DATE: ______________________

LENGTH OF INTERVIEW: (minutes) ________

The Federal Communications Commission is conducting a survey to determine the extent of interference to the reception of television or radio stations that you might be experiencing in this neighborhood. This survey is not concerned with any particular program or broadcast station. This survey will only take a few minutes of your time. Your answers will be confidential and, upon final tabulation, will neither identify you nor your address.

Interference to the reception of television may cause the picture on your television screen to become distorted, or lose its color. Also, you may, on occasion, hear voices other than those originating from the program source; noises, hum, tones, or a combination of these elements. The voices or sounds may also be a source of interference to the reception of radio broadcast stations. Any electronic device is susceptible, including such audio devices as phonographs, tape recorders, electronic organs, electric guitars, hearing aids, even your telephone.

1. Within the last six months have you experienced any type of interference to the reception of:

	Yes	No	Blk/ White	Color	Solid State	Make	Age (yrs)	Metal Cabinet
A. Television? Set #1								
Set #2								
Set #3								
B. Radio? Set #1			XXXXXXXXXXXXXX XXXXXXXXXXXXXX					
Set #2			XXXXXXXXXXXXXX XXXXXXXXXXXXXX					
Set #3			XXXXXXXXXXXXXX XXXXXXXXXXXXXX					
C. Audio Devices? Set #1			XXXXXXXXXXXXXX XXXXXXXXXXXXXX					
Set #2			XXXXXXXXXXXXXX XXXXXXXXXXXXXX					
Set #3			XXXXXXXXXXXXXX XXXXXXXXXXXXXX					
D. ______ (Other)			XXXXXXXXXXXXXX XXXXXXXXXXXXXX					

INTERVIEWER: IDENTIFY AUDIO DEVICES IN THE SPACE ADJACENT TO THE SET NUMBER.

IF THE RESPONDENT DOES NOT EXPERIENCE ANY INTERFERENCE PLEASE TERMINATE THE INTERVIEW. COMPLETE ITEM 5 AND PROCEED TO NEXT HOUSEHOLD. IF THE RESPONDENT IS UNCERTAIN PLEASE REVIEW THE DEFINITION OF INTERFERENCE.

2. Can you describe the nature of the interference?

CHECK ALL APPROPRIATE BOXES		(1) Not Irritating Set# 1	2	3	(2) Slightly Irritating Set# 1	2	3	(3) Very Irritating Set# 1	2	3
	TELEVISION									
a.	Video - blackout									
b.	Video - co-channel									
c.	Video - cross-hatching									
d.	Video - defective receiver									
e.	Video - electrical - mild									
f.	Video - electrical - severe									
g.	Video - fringe area reception									
h.	Video - ghosting									
i.	Video - modulation bars									
j.	Video - negative									
k.	Video - (other)									
l.	Audio - electrical									
m.	Audio - voices									
n.	Audio - voices (specific freqs.)									
o.	Audio - voices (all frequencies)									
p.	Audio - (other)									
	RADIO									
q.	Audio - defective receiver									
r.	Audio - electrical									
s.	Audio - fringe area reception									
t.	Audio - voices									
u.	Audio - voices (specific freqs.)									
v.	Audio - voices (all frequencies)									
w.	Audio - (other)									
	AUDIO DEVICES									
x.	Audio - defective equipment									
y.	Audio - voices									
z.	Audio - (other)									

INTERVIEWER: IF THE RESPONDENT INDICATES VIDEO INTERFERENCE, SHOW HIM/HER THE SERIES OF PHOTOGRAPHS AND ASK HIM/HER TO IDENTIFY THE ILLUSTRATION THAT BEST RESEMBLES THE TYPE OF INTERFERENCE PATTERN HE/SHE IS EXPERIENCING. (See pp. Z12 & Z13).

DETERMINE THE DEGREE OF IRRITATION BY SHOWING THE RESPONDENT THE APPROPRIATE CUE CARD AND HAVE HIM/HER SELECT THE DEGREE OF IRRITATION BY NUMBER. (See p. Z14).

3. A. We recognize that your viewing and listening habits might differ more during some parts of the year than others, and more during some days of the week than others. But, on the average, how much time do you spend each day:

	Never	1 to 60 minutes per day	1 to 4 hours per day	5 to 8 hours per day	9 hours per day or more	No response
i. Watching television?						
ii. Listening to the radio?						
iii. Playing records/tapes?						

B. How often do you receive interference?

OCCASIONALLY	DAILY	WEEKENDS	OTHER (specify)

C. How many minutes does the interference generally last when it is present?

____

4. A. Have you ever been able to identify and/or locate the source(s) of interference?

YES	NO	UNCERTAIN	NO RESPONSE

B. How were you able to do this?

C. What was the source(s) of interference?

D. (TO BE ANSWERED BY THE INTERVIEWER)
Was source reported to be the SUBJECT of this investigation?

YES	NO

4. E. Have you ever reported this interference problem(s) to an office of the FCC? (If YES, obtain date of report and office. If NO, ask question 4F.)

YES	NO	UNCERTAIN	NO RESPONSE

Date: ______________

Office: ____________

F. What was the primary reason why you decided not to complain of interference to our agency?

CHECK		
	i.	No response
	ii.	No particular reason
	iii.	Not enough time
	iv.	Did not know I had a problem that might be resolved by complaining
	v.	Did not know where to complain
	vi.	My neighbor complained for me
	vii.	(Other - specify)

5. (TO BE COMPLETED BY THE INTERVIEWER)

Approximate distance between RESPONDENT and SUBJECT:

CHECK		
	A.	Less than 50 feet
	B.	50 to 200 feet
	C.	200 to 500 feet
	D.	500 to 1000 feet

KEY TO PHOTOGRAPHS APPEARING ON PAGE 213

MILD ELECTRICAL	GHOST	OVERLOAD FROM FM ON ADJACENT CHANNEL
SEVERE ELECTRICAL	NO INTERFERENCE (TASO 1)	MODULATED CO-CHANNEL SIGNAL
WEAK SIGNAL	HORIZONTAL SYNC.	CW CO-CHANNEL SIGNAL


take it from here
737-8000

CUE CARD USED IN RESPONSE TO QUESTION 2, PAGE Z9

NOT IRRITATING	SLIGHTLY IRRITATING	VERY IRRITATING
1	2	3

RFI NEIGHBORHOOD SURVEY SKETCH FORM

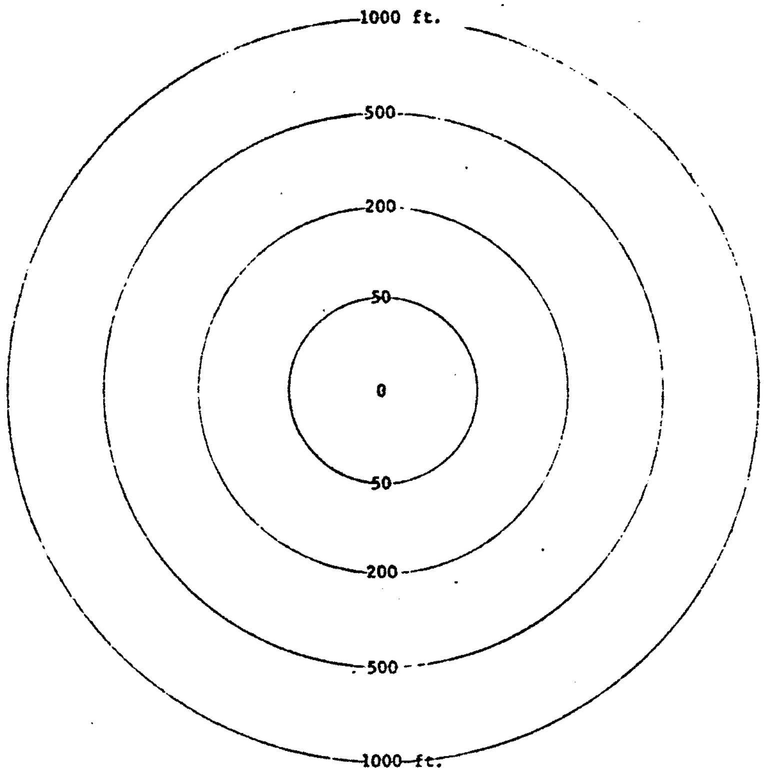
RFI NEIGHBORHOOD SURVEY SKETCH

Please note that the distances shown in feet between the concentric circles are not linear, i.e., not to scale.

N

Date: ____________________

City: ____________________



Draw a rough sketch of the area and indicate the approximate location (bearing and distance) of the COMPLAINANT(S) and RESPONDENTS, relative to true north. Center of sketch is SUBJECT'S location. Assign a number to each interview and identify the respondents in your sketch accordingly. If the respondent has an outdoor antenna, indicate the direction in which it is oriented by a small arrow.

Indicate by an arrow the direction of the arrival of TV broadcast stations that serve the area. Include the TV channel numbers and the cities in which the TV broadcast stations are situated.

APPENDIX AA

COMPUTER PROGRAMS

Two computer programs were employed in this study. Both were written in FORTRAN and run on the Commission's Honeywell Model 6023 computer. Program SKIP utilized the Honeywell system random number generator to form and print six sequences of 120 random integers between one and 360. One of these sequences was used by each of the participating offices in the selection of homes for interview in the Neighborhood Survey (see Appendix Z for a description of the RFI Neighborhood Survey procedures).

Computer program FXX033 was used to summarize the data collected during the RFI Neighborhood Survey as well as a portion of the subject data collected during the Technical Survey. With only minor modifications this program was capable of printing a summary for each interview, case, or office, plus an overall summary. In addition, record selection criteria could be changed to obtain a summary for any subset of the data. For example, a summary was made of all respondents receiving TVI who were able to identify the subject as the source, but had not complained to the FCC. In addition to summarizing the neighborhood survey data, this program also was used for data validation.

Computer listings and sample outputs of these two programs appear on the following pages.

LISTING OF PROGRAM SKIP

```
C
C      DIMENSION L(I,J) WITH I = NO OF DESIRED SEQUENCES
C      AND J = LENGTH OF EACH SEQUENCE
C
       INTEGER L(6,120)
C
C      GENERATE UNIFORM RANDOM NOS BETWEEN ONE & UPLIM
C
       UPLIM=360.
       DO 10 I=1,6
       DO 20 J=1,120
       R=RANDI(UPLIM)+1.
       IF(R.EQ.UPLIM+1.) R=R-.1
       L(I,J)=INT(R)
    20 CONTINUE
    10 CONTINUE
C
C      PRINT SEQUENCE NO. SEQUENCE
C
       WRITE(6,130)
       WRITE(6,130)
       DO 100 I=1,6
       WRITE(6,110) I
   110 FORMAT(1H ,12HSEQUENCE NO ,I2)
       WRITE(6,120) (L(I,J),J=1,120)
   120 FORMAT((10(I3,3X)))
       WRITE(6,130)
   130 FORMAT(/)
   100 CONTINUE
       STOP
       END
```

SAMPLE OUTPUT OF PROGRAM SKIP

~~SEQUENCE NO 1~~

22	309	247	118	107	282	290	261	312	222
315	101	195	46	126	303	340	237	179	2
~~300~~	~~134~~	~~354~~	~~216~~	~~340~~	~~199~~	~~136~~	~~3~~	~~359~~	~~138~~
94	243	94	50	27	207	303	4	134	244
329	349	249	320	306	133	15	297	163	21
~~54~~	~~59~~	~~204~~	~~270~~	~~264~~	~~32~~	~~234~~	~~214~~	~~346~~	~~224~~
330	327	57	39	168	318	292	162	68	74
43	12	303	85	236	212	19	276	95	59
~~240~~	~~331~~	~~55~~	~~172~~	~~163~~	~~302~~	~~243~~	~~223~~	~~275~~	~~332~~
272	138	325	127	117	32	71	315	96	310
78	319	253	323	308	338	33	345	325	295
~~70~~	~~207~~	~~166~~	~~138~~	~~270~~	~~124~~	~~312~~	~~356~~	~~159~~	~~172~~

LISTING OF PROGRAM FXX033

```
      INTEGER *1IOFFICE,IDATE*4,INTNO,ICARD,INTVWR,ISUBJ*2,ILENGTH*2
      INTEGER *1HNTNO/0/,HNTVWR,KSUBJ*2,HDATE*5/0/
      INTEGER *1IQ1*2(5,6),IMISS1,IQ2*2(8,4),IMISS2,IQ3A(3),IQ3B
      INTEGER *1IQ3C*2,IQ4A,IQ4B,IQ4C,IQ4D,IQ4E(2),IQ4F,IQ5,IQ6A,IQ6B*3
      INTEGER *2IQ6C(2),IQ6D,IQ6E(3),IQ6F(3),J2*3(33,9)/297*0/
      INTEGER *3HOFFICE*1/0/,J1(5,47)/235*0/,JMISS1(2)/2*0/
      INTEGER *3J3A(3,6)/18*0/,J3B(5)/5*0/,J3C*6/0/,JQ3C/0/
      INTEGER *3J4A(4)/4*0/,J4B(5)/5*0/,J4C(5)/5*0/,J4D(3)/3*0/
      INTEGER *3J4E1(4)/4*0/,J4E2(4)/4*0/,J4F(10)/10*0/,J5(5)/5*0/
      INTEGER *3J6A(4)/4*0/,J6B/0/,JQ6B/0/,J6C(4)/4*0/,J6D/0/
      INTEGER *3J6E(3)/3*0/,JQ6E(3)/3*0/,J6F(3)/3*0/,JQ6F(3)/3*0/
      INTEGER *3K1(5,47)/235*0/,KMISS1(2)/2*0/,K2(33,9)/297*0/
      INTEGER *3K3A(3,6)/18*0/,K3B(5)/5*0/,K3C*6/0/,KQ3C/0/
      INTEGER *3K4A(4)/4*0/,K4B(5)/5*0/,K4C(5)/5*0/,K4D(3)/3*0/
      INTEGER *3K4E1(4)/4*0/,K4E2(4)/4*0/,K4F(10)/10*0/,K5(5)/5*0/
      INTEGER *3K6A(4)/4*0/,K6B/0/,KQ6B/0/,K6C(4)/4*0/,K6D/0/
      INTEGER *3K6E(3)/3*0/,K6F(3)/3*0/,KQ6F(3)/3*0/,PAGE/0/
      INTEGER *4JINT/0/,KINT/0/,JWIX/0/,KWIX/0/,IHOLD*2,LAST*1/0/
      INTEGER *3JMISS2(2)/2*0/,KMISS2(2)/2*0/
      INTEGER *2NEWSUBJ/0/,HSUBJ/0/,KQ6E*3(3)/3*0/
      CHARACTER *32H2(33),HO*13(6),JL*11(5),H*11,H3A*9(3)
      REAL *8HOLD,HOLD1,HOLD2

      H="YES  NO  NR"
      HO(1)="BALTIMORE    "
      HO(2)="BUFFALO      "
      HO(3)="KANSAS CITY  "
      HO(4)="NORFOLK      "
      HO(5)="SAN FRANCISCO"
      HO(6)="SEATTLE      "
      H2(1)="VIDEO - BLACKOUT                "
      H2(2)="VIDEO - CO-CHANNEL              "
      H2(3)="VIDEO - CROSS-HATCHING          "
      H2(4)="VIDEO - DEFECTIVE RECEIVER      "
      H2(5)="VIDEO - ELECTRICAL - MILD       "
      H2(6)="VIDEO - ELECTRICAL - SEVERE     "
      H2(7)="VIDEO - FRINGE AREA RECEPTION   "
      H2(8)="VIDEO - GHOSTING                "
      H2(9)="VIDEO - MODULATION BARS         "
      H2(10)="VIDEO - NEGATIVE               "
      H2(11)="VIDEO - (OTHER)                "
      H2(12)="AUDIO - ELECTRICAL             "
      H2(13)="AUDIO - VOICES                 "
      H2(14)="AUDIO - VOICES (SPECIFIC FREQS.)"
      H2(15)="AUDIO - VOICES (ALL FREQUENCIES)"
      H2(16)="AUDIO - (OTHER)                "
      H2(21)="AUDIO - DEFECTIVE RECEIVER     "
      H2(22)="AUDIO - ELECTRICAL             "
      H2(23)="AUDIO - FRINGE AREA RECEPTION  "
      H2(24)="AUDIO - VOICES                 "
      H2(25)="AUDIO - VOICES (SPECIFIC FREQS.)"
      H2(26)="AUDIO - VOICES (ALL FREQUENCIES)"
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      H2(27)="AUDIO - (OTHER)                     "
      H2(31)="AUDIO - DEFECTIVE EQUIPMENT         "
      H2(32)="AUDIO - VOICES                      "
      H2(33)="AUDIO - (OTHER)                     "
      H3A(1)="TV       "
      H3A(2)="RADIO    "
      H3A(3)="REC/TAPES"
      JL(1)="1A.TV   #1  "
      JL(2)="        #2  "
      JL(3)="        #3  "
      JL(4)=" B.RADIO    "
      JL(5)=" C.AUDIO    "
    5 READ(7,10,END=800)IOFFICE,IDATE,INTNO,ICARD,INTVWR,ISUBJ,ILENGTH,
     &((IQ1(I,J),J=1,6),I=1,3),(IQ1(I,1),(IQ1(I,J),J=3,6),I=4,5),
     &IMISS1,((IQ2(I,J),J=1,4),I=1,5)
   10 FORMAT(I1,I4,2(3I1,2I2),2(4I1,2I2),2(3I1,2I2),5I1,I2,4(3I1,I2))
      READ(7,11,END=800)((IQ2(I,J),J=1,4),I=6,8),IMISS2,
     &(IQ3A(I),I=1,3),IQ3B,IQ3C,IQ4A,IQ4B,IQ4C,IQ4D,IQ4E(1),
     &IQ4E(2),IQ4F,IQ5,IQ6A,IQ6B,(IQ6C(I),I=1,2),
     &IQ6D,(IQ6E(I),I=1,3),(IQ6F(I),I=1,3)
   11 FORMAT(7X,3(3I1,I2),5I1,I2,9I1,I3,I1,I2,2X,7I2)

   13 JINT=JINT+1
      JLENGTH=JLENGTH+ILENGTH
      IF(IQ2(1,1).NE.0)JWIX=JWIX+1
      J5(IQ5)=J5(IQ5)+1
   18 DO 20 I=1,3
      DO 19 J=1,4
      J1(I,IQ1(I,J)+3*(J-1))=J1(I,IQ1(I,J)+3*(J-1))+1
   19 CONTINUE
      J1(I,IQ1(I,6)+42)=J1(I,IQ1(I,6)+42)+1
      IF(IQ1(I,5).EQ.33)GO TO 20
      J1(I,46)=J1(I,46)+IQ1(I,5)
      J1(I,47)=J1(I,47)+1
   20 CONTINUE
      DO 22 I=4,5
      DO 21 J=3,4
      J1(I,IQ1(I,J)+3*(J-1))=J1(I,IQ1(I,J)+3*(J-1))+1
   21 CONTINUE
      J1(I,IQ1(I,1))=J1(I,IQ1(I,1))+1
      J1(I,IQ1(I,6)+42)=J1(I,IQ1(I,6)+42)+1
      IF(IQ1(I,5).EQ.33)GO TO 22
      J1(I,46)=J1(I,46)+IQ1(I,5)
      J1(I,47)=J1(I,47)+1
   22 CONTINUE
      JMISS1(IMISS1)=JMISS1(IMISS1)+1
      IF(IQ2(1,1).EQ.0.AND.NEWSUBJ.NE.0)GO TO 52
      IF(IQ2(1,1).EQ.0)GO TO 39
      DO 30 I=1,8
      J2(IQ2(I,4),IQ2(I,2)+3*(IQ2(I,3)-1))=
     &J2(IQ2(I,4),IQ2(I,2)+3*(IQ2(I,3)-1))+1
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```
   30 CONTINUE
      JMISS2(IMISS2)=JMISS2(IMISS2)+1
      DO 35 I=1,3
      J3A(I,IQ3A(I))=J3A(I,IQ3A(I))+1
   35 CONTINUE
      J3B(IQ3B)=J3B(IQ3B)+1
      IF(IQ3C.EQ.0.OR.IQ3C.EQ.99)GO TO 38
      J3C=J3C+IQ3C
      JQ3C=JQ3C+1
   38 J4A(IQ4A)=J4A(IQ4A)+1
      J4B(IQ4B)=J4B(IQ4B)+1
      J4C(IQ4C)=J4C(IQ4C)+1
      J4D(IQ4D)=J4D(IQ4D)+1
      J4E2(IQ4E(2))=J4E2(IQ4E(2))+1
      J4E1(IQ4E(1))=J4E1(IQ4E(1))+1
      J4F(IQ4F+1)=J4F(IQ4F+1)+1
   39 CONTINUE
      J6A(IQ6A)=J6A(IQ6A)+1
      J6B=J6B+IQ6B
      JQ6B=JQ6B+1
      J6C(IQ6C(1))=J6C(IQ6C(1))+1
      J6C(4)=J6C(4)+IQ6C(2)
      J6D=J6D+IQ6D
      DO 50 I=1,3
      IF(IQ6E(I).EQ.0)GO TO 40
      J6E(I)=J6E(I)+IQ6E(I)
      JQ6E(I)=JQ6E(I)+1
   40 IF(IQ6F(I).EQ.0)GO TO 50
      J6F(I)=J6F(I)+IQ6F(I)
      JQ6F(I)=JQ6F(I)+1
   50 CONTINUE
   52 HOFFICE=IOFFICE
      HNTNO=INTNO
      HDATE=IDATE
      HNTVWR=INTVWR
      KSUBJ=ISUBJ
   55 PAGE=PAGE+1
      IF(LAST.NE.2)GO TO 59
      WRITE(6,56)PAGE
   56 FORMAT(1H1,7HSUMMARY,48X,23HRFI NEIGHBORHOOD SURVEY,12X,
     &17HFXXC33-C1    PAGE ,I3)
      GO TO 64
   59 WRITE(6,60)HOFFICE,HO(HOFFICE),PAGE
   60 FORMAT(1H1,10HLOCATION- ,I1,1H-,A13,30X,
     &23HRFI NEIGHBORHOOD SURVEY,12X,17HFXXC33-01    PAGE ,I3)
      WRITE(6,61)HOFFICE,HDATE+90000,HNTNO,HNTVWR,KSUBJ
   61 FORMAT(1H0,8HCASE #  ,I1,1H-,I4,1H-,I1,10X,12HINTERVIEWER-,
     &I1,10X,8HSUBJECT-,I2)
   64 HOLD=FLOAT(JLENGTH)/FLOAT(JINT)
      WRITE(6,65)JINT,JINT-JWIX,JWIX,IFIX(HOLD+.5)
   65 FORMAT(1H0,8X,13H# INTERVIEWS-,I4,10X,9H# W/O IX-,I4,
     &8X,8H# W/ IX-,I4,10X,24HAVE. LENGTH OF INT(MIN)-,I2)
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      WRITE(6,70)
   70 FORMAT(1H0,16X,2HIX,12X,3HB/W,11X,2HSS,32X,4HMAKE,35X,
     &9HMETAL CAB)
      WRITE(6,75)H,H,H,H
   75 FORMAT(1H ,11X,3(A11,3X),30HAD  GE  HI  MA  MU  PA  PH  RC,2X,
     &28HSE  SO  WA  ZE  OT  NR   AGE,3X,A11)
      DO 85 I=1,5
      HOLD=0.
      IF(J1(I,47).EQ.0)GC TO 76
      HOLD=FLOAT(J1(I,46))/FLOAT(J1(I,47))
   76 WRITE(6,80) JL(I),(J1(I,J),J=1,22),J1(I,42),IFIX(HOLD+.5),
     &(J1(I,J),J=43,45)
   80 FORMAT(1H ,A9,3(2X,3(I3,1X)),14(1X,I3),3X,I2,3X,3(1X,I3))
   85 CONTINUE
      WRITE(6,90)JMISS1(1)
   90 FORMAT(1H0,14HMISSING DATA- ,I3)
      WRITE(6,95)
   95 FORMAT(1H0,20H3A.VIEWING FREQUENCY,23X,5HNEVER,5X,8H1-60 M/D,
     &5X,7H1-4 H/D,5X,7H5-6 H/D,5X,6H9+ H/D,5X,2HNR)
      DO 105 I=1,3
      WRITE(6,100)H3A(I),(J3A(I,J),J=1,6)
  100 FORMAT(1H ,28X,A9,7X,I3,8X,I3,10X,I3,9X,I3,8X,I3,6X,I3)
  105 CONTINUE
      WRITE(6,110)
  110 FORMAT(1H0,16H B.INTERFERENCE?,5X,12HOCCASIONALLY,3X,5HDAILY,
     &3X,8HWEEKENDS,3X,5HOTHER,5X,2HNR)
      WRITE(6,115)(J3B(I),I=1,5)
  115 FORMAT(1H ,24X,I3,9X,I3,6X,I3,7X,I3,5X,I3)
      IF(JQ3C.EQ.0)JQ3C=1
      HOLD=FLOAT(J3C)/FLOAT(JQ3C)
      WRITE(6,120)IFIX(HOLD+.5)
  120 FORMAT(1H0,14H C.DURATION - ,I2)
      WRITE(6,125)(J4A(I),I=1,4)
  125 FORMAT(1H0,24H4A.ABLE TO ID SOURCE IX?,4X,4HYES-,I3,4X,3HNO-,
     &I3,4X,10HUNCERTAIN-,I3,4X,3HNR-,I3)
      WRITE(6,130)(J4B(I),I=1,5)
  130 FORMAT(1H0,22H B.HOW?  VOICES,CONV.-,I3,3X,14HANTENNA INST.-,
     &I3,3X,23HIX WHEN SCURCE AT HCME-,I3,4X,6HOTHER-,I3,3X,3HNR-,I3)
      WRITE(6,135)(J4C(I),I=1,5)
  135 FORMAT(1H0,10H C.SOURCE?,3X,8HSUBJECT-,I3,3X,16HNEIGHBORHOOD CB-,
     &I3,3X,11HDON'T KNOW-,I3,3X,6HOTHER-,I3,3X,3HNR-,I3)
      WRITE(6,140)J4D(1),J4D(2),J4D(3)
  140 FORMAT(1H0,37H D.WAS SOURCE REPORTED TO BE SUBJECT?,4X,4HYES-,
     &I3,5X,3HNO-,I3,5X,3HNR-,I3)
      WRITE(6,145)(J4E1(I),I=1,4)
  145 FORMAT(1H0,19H E.REPORTED TO FCC?,4X,4HYES-,I3,3X,3HNO-,I3,3X,
     &10HUNCERTAIN-,I3,3X,3HNR-,I3)
      WRITE(6,150)(J4E2(I),I=1,4)
  150 FORMAT(1H ,3X,11HDATE/OFFICE,4X,4HN/N-,I3,3X,4HY/Y-,I3,3X,
     &4HY/N-,I3,3X,4HN/Y-,I3)
      WRITE(6,155)(I-1,I=1,10)
  155 FORMAT(1H0,29H F.REASON FOR NOT COMPLAINING,7X,I1,9(5X,I1))
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      WRITE(6,160)(J4F(I),I=1,10)
  160 FORMAT(1H ,31X,10(3X,I3))
      WRITE(6,165)
  165 FORMAT(1H0,49H5.APPROX. DIST. BET. SUBJECT AND RESPONDENT (FT)-,
     &7X,4H0-50,4X,6H50-200,4X,7H200-500,4X,8H500-1000,4X,2HNR)
      WRITE(6,170)(J5(I),I=1,5)
  170 FORMAT(1H ,56X,I3,6X,I3,8X,I3,9X,I3,5X,I3)
      WRITE(6,173)
  173 FORMAT(1H0,21H6.SUBJECT INFORMATION)
      WRITE(6,175)(J6A(I),I=1,4)
  175 FORMAT(1H0,17H   LINEAR?     NO-,I3,4X,18HYES(PWR MEASURED)-,
     &I3,4X,19HYES(PWR NOT MEAS.)-,I3,3X,3HNR-,I3)
      HOLD=FLOAT(J6B)/FLOAT(JQ6B)
      WRITE(6,180)IFIX(HCLD+.5)
  180 FORMAT(1H0,3X,10HMAX POWER-,I3)
      IF(JQ6B.EQ.0)JQ6B=1
      HOLD=FLOAT(J6C(4))/FLOAT(JQ6B)
      HOLD2=FLOAT(J6D)*.1/FLOAT(JQ6B)
      WRITE(6,185)(J6E(I),I=1,3),IFIX(HOLD+.5),HOLD2
  185 FORMAT(1H0,3X,7HANTENNA,5X,12HDIRECTIONAL-,I3,3X,
     &16HNON-DIRECTIONAL-,
     &I3,3X,3HNR-,I3,7X,14HRELATIVE GAIN-,I2,4X,4HSWR-,F3.1)
      IF(JQ6E(1).EQ.0)JQ6E(1)=1
      IF(JQ6E(2).EQ.0)JQ6E(2)=1
      IF(JQ6E(3).EQ.0)JQ6E(3)=1
      HOLD=FLOAT(J6E(1))/FLOAT(JQ6E(1))
      HOLD1=FLOAT(J6E(2))/FLOAT(JQ6E(2))
      HOLD2=FLOAT(J6E(3))/FLOAT(JQ6E(3))
      WRITE(6,190)IFIX(HOLD+.5),IFIX(HOLD1+.5),IFIX(HOLD2+.5)
  190 FORMAT(1H0,3X,33HHARMONIC OUTPUT(RELATIVE TO FMD.),4X,I2,
     &4H 2ND,4X,I2,4H 3RD,4X,I2,4H 7TH)
      IF(JQ6F(1).EQ.0)JQ6F(1)=1
      IF(JQ6F(2).EQ.0)JQ6F(2)=1
      IF(JQ6F(3).EQ.0)JQ6F(3)=1
      HOLD=FLOAT(J6F(1))/FLOAT(JQ6F(1))
      HOLD1=FLOAT(J6F(2))/FLOAT(JQ6F(2))
      HOLD2=FLOAT(J6F(3))/FLOAT(JQ6F(3))
      WRITE(6,195)IFIX(HOLD+.5),IFIX(HOLD1+.5),IFIX(HOLD2+.5)
  195 FORMAT(1H0,3X,37HSIGNAL STRENGTH OF SELECTED CHANNELS-,3X,I2,
     &4H CH2,5X,I2,4H CH5,5X,I2,4H CH9)
      PAGE=PAGE+1
      IF(LAST.NE.2)GO TO 199
      WRITE(6,196)PAGE
  196 FORMAT(1H1//,7HSUMMARY,48X,23HRFI NEIGHBORHOOD SURVEY,
     &12X,17HFXX033-01    PAGE ,I3)
      GO TO 204
  199 WRITE(6,200)HOFFICE,HO(HOFFICE),PAGE
  200 FORMAT(1H1//,10HLOCATION  ,I1,1H-,A13,30X,
     &23HRFI NEIGHBORHOOD SURVEY,12X,17HFXX033-01    PAGE ,I3)
      WRITE(6,202)HOFFICE,HDATE+90000,HNTNO,HNTVWR,KSUBJ
  202 FORMAT(1H0,8HCASE #  ,I1,1H-,I4,1H-,I1,10X,12HINTERVIEWER-,
     &I1,10X,8HSUBJECT-,I2)
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204 WRITE(6,205)
205 FORMAT(1H0///,2H2.,39X,10HNON-IRRIT.,8X,14HSLIGHT. IRRIT.,8X,
   &11HVERY IRRIT.)
    WRITE(6,210)
210 FORMAT(1H ,33X,3(5X,15HSET    SET    SET))
    WRITE(6,211)
211 FORMAT(1H ,32X,3(7X,1H1,5X,1H2,5X,1H3))
    WRITE(6,215)
215 FORMAT(1H ,10HTELEVISION)
    DO 250 I=1,33
    IF(I.GT.16.AND.I.LT.21)GO TO 250
    IF(I.GT.27.AND.I.LT.31)GO TO 250
    WRITE(6,220)H2(I),(J2(I,J),J=1,9)
220 FORMAT(1H ,A32,3(5X,I3,3X,I3,3X,I3))
    IF(I.NE.11)GO TO 230
    WRITE(6,225)
225 FORMAT(1H )
    GO TO 250
230 IF(I.NE.16)GO TO 240
    WRITE(6,235)
235 FORMAT(1H0,5HRADIO)
    GO TO 250
240 IF(I.NE.27)GO TO 250
    WRITE(6,245)
245 FORMAT(1H0,13HAUDIO DEVICES)
250 CONTINUE
    WRITE(6,255)JMISS2(1)
255 FORMAT(1H0//,15HMISSING DATA -- ,I3)
    IF(LAST.EQ.2)GO TO 990
    KINT=KINT+JINT
    JINT=0
    KWIX=KWIX+JWIX
    JWIX=0
    KLENGTH=KLENGTH+JLENGTH
    JLENGTH=0
    DO 610 J=1,47
    DO 610 I=1,5
    K1(I,J)=K1(I,J)+J1(I,J)
    J1(I,J)=0
610 CONTINUE
    KMISS1(1)=KMISS1(1)+JMISS1(1)
    JMISS1(1)=0
    KMISS1(2)=KMISS1(2)+JMISS1(2)
    JMISS1(2)=0
    DO 620 J=1,9
    DO 620 I=1,33
    K2(I,J)=K2(I,J)+J2(I,J)
    J2(I,J)=0
620 CONTINUE
    KMISS2(1)=KMISS2(1)+JMISS2(1)
    JMISS2(1)=0
    KMISS2(2)=KMISS2(2)+JMISS2(2)
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```
      JMISS2(2)=0
      DO 630 J=1,6
      DO 630 I=1,3
      K3A(I,J)=K3A(I,J)+J3A(I,J)
      J3A(I,J)=0
  630 CONTINUE
      DO 640 I=1,5
      K3B(I)=K3B(I)+J3B(I)
      J3B(I)=0
  640 CONTINUE
      K3C=K3C+J3C
      J3C=0
      KQ3C=KQ3C+JQ3C
      JQ3C=0
      DO 650 I=1,4
      K4A(I)=K4A(I)+J4A(I)
      J4A(I)=0
  650 CONTINUE
      DO 660 I=1,5
      K4B(I)=K4B(I)+J4B(I)
      J4B(I)=0
      K4C(I)=K4C(I)+J4C(I)
      J4C(I)=0
  660 CONTINUE
      K4D(1)=K4D(1)+J4D(1)
      J4D(1)=0
      K4D(2)=K4D(2)+J4D(2)
      J4D(2)=0
      K4D(3)=K4D(3)+J4D(3)
      J4D(3)=0
      DO 670 I=1,4
      K4E1(I)=K4E1(I)+J4E1(I)
      J4E1(I)=0
      K4E2(I)=K4E2(I)+J4E2(I)
      J4E2(I)=0
  670 CONTINUE
      DO 680 I=1,10
      K4F(I)=K4F(I)+J4F(I)
      J4F(I)=0
  680 CONTINUE
      DO 690 I=1,5
      K5(I)=K5(I)+J5(I)
      J5(I)=0
  690 CONTINUE
      IF(HSUBJ.EQ.ISUBJ)GO TO 730
      HSUBJ=ISUBJ
      DO 700 I=1,4
      K6A(I)=K6A(I)+J6A(I)
  700 CONTINUE
      K6B=K6B+J6B
      KQ6B=KQ6B+JQ6B
      DO 710 I=1,4
```

```
~~K6C(I)=K6C(I)+J6C(I)~~
710 CONTINUE
      K6D=K6D+J6D
~~DO 720 I=1,3~~
      K6E(I)=K6E(I)+J6E(I)
      KQ6E(I)=KQ6E(I)+JQ6E(I)
~~K6F(I)=K6F(I)+J6F(I)~~
      KQ6F(I)=KQ6F(I)+JQ6F(I)
720 CONTINUE
~~730 DO 740 I=1,4~~
      J6A(I)=0
      J6C(I)=0
~~740 CONTINUE~~
      DO 745 I=1,3
      J6E(I)=0
~~JQ6E(I)=0~~
      J6F(I)=0
      JQ6F(I)=0
~~745 CONTINUE~~
      J6B=0
      J6D=0
~~JQ6B=0~~
      GO TO 5
800 LAST=2
~~JINT=JINT+KINT~~
      JWIX=JWIX+KWIX
      JLENGTH=JLENGTH+KLENGTH
~~DO 810 J=1,47~~
      DO 810 I=1,5
      J1(I,J)=J1(I,J)+K1(I,J)
~~810 CONTINUE~~
      JMISS1(1)=JMISS1(1)+KMISS1(1)
      JMISS1(2)=JMISS1(2)+KMISS1(2)
~~DO 820 J=1,9~~
      DO 820 I=1,33
      J2(I,J)=J2(I,J)+K2(I,J)
~~820 CONTINUE~~
      JMISS2(1)=JMISS2(1)+KMISS2(1)
      JMISS2(2)=JMISS2(2)+KMISS2(2)
~~DO 830 J=1,6~~
      DO 830 I=1,3
      J3A(I,J)=J3A(I,J)+K3A(I,J)
~~830 CONTINUE~~
      DO 840 I=1,5
      J3B(I)=J3B(I)+K3B(I)
~~J4B(I)=J4B(I)+K4B(I)~~
      J4C(I)=J4C(I)+K4C(I)
      J5(I)=J5(I)+K5(I)
~~840 CONTINUE~~
      DO 850 I=1,4
      J4A(I)=J4A(I)+K4A(I)
~~J4E1(I)=J4E1(I)+K4E1(I)~~
```

```
      J4E2(I)=J4E2(I)+K4E2(I)
      J6A(I)=J6A(I)+K6A(I)
      J6C(I)=J6C(I)+K6C(I)
850   CONTINUE
      J3C=J3C+K3C
      JQ3C=JQ3C+KQ3C
      J4D(1)=J4D(1)+K4D(1)
      J4D(2)=J4D(2)+K4D(2)
      J4D(3)=J4D(3)+K4D(3)
      DO 880 I=1,10
      J4F(I)=J4F(I)+K4F(I)
880   CONTINUE
      J6B=J6B+K6B
      JQ6B=JQ6B+KQ6B
      J6D=J6D+K6D
      DO 890 I=1,3
      J6E(I)=J6E(I)+K6E(I)
      JQ6E(I)=JQ6E(I)+KQ6E(I)
      J6F(I)=J6F(I)+K6F(I)
      JQ6F(I)=JQ6F(I)+KQ6F(I)
890   CONTINUE
      GO TO 55
990   STOP
      END
```

CASE # 3-0767-6 INTERVIEWER-2 SUBJECT-11

INTERVIEWS- 1 # W/O IX- 0 # W/ IX- 1 AVE. LENGTH OF INT(MIN)- 5

	IX			B/W			SS			MAKE															METAL CAB		
	YES	NO	NR	YES	NO	NR	YES	NO	NR	AD	GE	HI	MA	MU	PA	PH	RC	SE	SO	WA	ZE	OT	NR	AGE	YES	NO	NR
1A.TV #1	0	1	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	5	0	0	1
#2	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
#3	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
B.RADIO	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
C.AUDIO	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1

MISSING DATA- 0

3A.VIEWING FREQUENCY.	NEVER	1-60 M/D	1-4 H/D	5-8 H/D	9+ H/D	NR
TV	0	0	0	0	0	1
RADIO	0	0	0	0	0	1
REC/TAPES	0	0	1	0	0	0

B.INTERFERENCE	OCCASIONALLY	DAILY	WEEKENDS	OTHER	NR
	1	0	0	0	0

C.DURATION - 10

4A.ABLE TO ID SOURCE IX YES- 1 NO- 0 UNCERTAIN- 0 NR- 0

B.HOW VOICES,CONV.- 0 ANTENNA INST.- 0 IX WHEN SOURCE AT HOME- 0 OTHER- 1 NR- 0

C.SOURCE SUBJECT- 0 NEIGHBORHOOD CB- 1 DON'T KNOW- 0 OTHER- 0 NR- 0

D.WAS SOURCE REPORTED TO BE SUBJECT YES- 1 NO- 0 NR- 0

E.REPORTED TO FCC YES- 0 NO- 1 UNCERTAIN- 0 NR- 0
DATE/OFFICE N/N- 1 Y/Y- 0 Y/N- 0 N/Y- 0

F.REASON FOR NOT COMPLAINING	0	1	2	3	4	5	6	7	8	9
	0	1	0	0	0	0	0	0	0	0

5.APPROX. DIST. BET. SUBJECT AND RESPONDENT (FT)-	0-50	50-200	200-500	500-1000	NR
	0	1	0	0	0

6.SUBJECT INFORMATION

LINEAR NO- 0 YES(PWR MEASURED)- 1 YES(PWR NOT MEAS.)- 0 NR- 0

MAX POWER-175

ANTENNA DIRECTIONAL- 1 NON-DIRECTIONAL- 0 NR- 0 RELATIVE GAIN-12 SWR-1.1

HARMONIC OUTPUT(RELATIVE TO FND.) 56 2ND 48 3RD 0 7TH

SIGNAL STRENGTH OF SELECTED CHANNELS- 0 CH2 77 CH5 45 CH9

AA13

SAMPLE OUTPUT OF PROGRAM FXX033

LOCATION 3-KANSAS CITY   RFI NEIGHBORHOOD SURVEY   FXX033-01   PAGE 8

CASE # 3-0767-6   INTERVIEWER-2   SUBJECT-11

2.	NON-IRRIT. SET 1	SET 2	SET 3	SLIGHT. IRRIT. SET 1	SET 2	SET 3	VERY IRRIT. SET 1	SET 2	SET 3
TELEVISION									
VIDEO - BLACKOUT	0	0	0	0	0	0	0	0	0
VIDEO - CO-CHANNEL	0	0	0	0	0	0	0	0	0
VIDEO - CROSS-HATCHING	0	0	0	0	0	0	0	0	0
VIDEO - DEFECTIVE RECEIVER	0	0	0	0	0	0	0	0	0
VIDEO - ELECTRICAL - MILD	0	0	0	0	0	0	0	0	0
VIDEO - ELECTRICAL - SEVERE	0	0	0	0	0	0	0	0	0
VIDEO - FRINGE AREA RECEPTION	0	0	0	0	0	0	0	0	0
VIDEO - GHOSTING	0	0	0	0	0	0	0	0	0
VIDEO - MODULATION BARS	0	0	0	0	0	0	0	0	0
VIDEO - NEGATIVE	0	0	0	0	0	0	0	0	0
VIDEO - (OTHER)	0	0	0	0	0	0	0	0	0
AUDIO - ELECTRICAL	0	0	0	0	0	0	0	0	0
AUDIO - VOICES	0	0	0	0	0	0	0	0	0
AUDIO - VOICES (SPECIFIC FREQS.)	0	0	0	0	0	0	0	0	0
AUDIO - VOICES (ALL FREQUENCIES)	0	0	0	0	0	0	0	0	0
AUDIO - (OTHER)	0	0	0	0	0	0	0	0	0
RADIO									
AUDIO - DEFECTIVE RECEIVER	0	0	0	0	0	0	0	0	0
AUDIO - ELECTRICAL	0	0	0	0	0	0	0	0	0
AUDIO - FRINGE AREA RECEPTION	0	0	0	0	0	0	0	0	0
AUDIO - VOICES	0	0	0	0	0	0	0	0	0
AUDIO - VOICES (SPECIFIC FREQS.)	0	0	0	0	0	0	0	0	0
AUDIO - VOICES (ALL FREQUENCIES)	0	0	0	0	0	0	0	0	0
AUDIO - (OTHER)	0	0	0	0	0	0	0	0	0
AUDIO DEVICES									
AUDIO - DEFECTIVE EQUIPMENT	0	0	0	0	0	0	0	0	0
AUDIO - VOICES	0	0	0	1	0	0	0	0	0
AUDIO - (OTHER)	0	0	0	0	0	0	0	0	0

MISSING DATA - 0

SAMPLE OUTPUT OF PROGRAM FXX033

APPENDIX AB

STATISTICAL APPENDIX

Stratum Estimates of TVI in 72 Neighborhoods

The stratum[1/] estimates (see p. B4) of the extent of TVI in the 72 neighborhoods surveyed were formed by constructing 95 percent confidence intervals for a population proportion, based on the normal approximation to the binomial with a finite population correction (fpc) factor. To allow for a possible ± 10 percent error in the estimation of the number of dwellings, the lower bound for each estimate was reduced by 10 percent and each upper bound was increased by 10 percent. The formulae for these calculations appear below. Let:

Ni = estimated number of dwellings in the ith stratum;

Mi = number of respondents in the ith stratum;

Ri = number of respondents with TVI in the ith stratum;

Li = lower 95 percent confidence limit for the population proportion (based on the normal approximation to binomial) in the ith stratum; and

Ui = upper 95 percent confidence limit for the population proportion (based on the normal approximation to the binomial) in the ith stratum.

Then Fi = finite population correction factor = $\sqrt{(Ni-Mi)/Ni}$ for the ith stratum;

$\hat{L}i$ = adjusted lower 95 percent confidence limit for the population proportion in the ith stratum
= (Li - Ri/Mi)Fi + Ri/Mi;

1/ A stratum in sampling theory is defined as a subpopulation which, when combined with the other (nonoverlapping) strata, makes up the whole of the population. In this case, the four "donut-shaped" areas about the subject comprise the strata.

$\hat{U}i$ = adjusted upper 95 percent confidence limit for the population proportion in the ith stratum
= $(Ui - Ri/Mi)Fi + Ri/Mi$;

Bi = lower 95 percent confidence limit on number of dwellings with TVI (with fpc) in the ith stratum = $(\hat{L}i)(Ni)$;

Ci = upper 95 percent confidence limit of number of dwellings with TVI (with fpc) in the ith stratum = $(\hat{U}i)(Ni)$;

Gi = estimated number of dwellings with TVI in the ith stratum = $(Ri/Mi)Ni$;

Ei = lower 95 percent confidence limit (adjusted for possible accounting errors) for estimate of number of dwellings with TVI in the ith stratum = $(.9)(Bi)$.

Hi = upper 95 percent confidence limit (adjusted for possible accounting errors) for the estimate of the number of dwellings with TVI in the ith stratum = $(1.1)(Ci)$.

Overall Estimates

The 95 percent confidence limits for the overall estimates of the number of dwellings in the 72 neighborhoods which experience TVI and the number of dwellings which experience TVI and have named the subject as the source are estimated by a different method [2/] from that used for the stratum estimates. The formulas for the confidence limits on the population mean per unit are given below. For a given stratum h let:

Nh = total number of units;

Mh = number of units in sample;

Yhi = value obtained for the ith unit;

Wh = Nh/N = stratum weight;

$\overline{Y}h = (\sum_{i=1}^{Mh} Yhi)/Mh$ = sample mean;

2/ William G. Cochran, Sampling Techniques (New York, 1953), pp. 87-94.

$$S^2(\overline{Y}st) = \sum_{h=1}^{L} [(Wh)^2(Sh)^2/(Mh)] - \sum_{h=1}^{L} [(Wh)(Sh)^2/N]$$

= unbiased estimate of the variance of $\overline{Y}st$; and

$$Sh^2 = [1/(Mh - 1)] \sum_{i=1}^{Mh} (Yhi - \overline{Y}h)^2.$$

Then if $\overline{Y}st$ is normally distributed and $S(\overline{Y}st)$ is well-determined, the confidence limits for the overall estimates are given by $\overline{Y}st \pm (T)S(\overline{Y}st)$, where T is the appropriate value taken from the normal distribution table. These limits were then adjusted outward by ten percent to cover accounting errors.

Effect of Distance from Subject on Likelihood of TVI

An examination was made of the effect of distance from the subject on the likelihood of receiving TVI. A One-Factor Analysis of Variance (ANOVA) was performed on the Neighborhood Survey data, with the presence of TVI as the dependent variable and distance from the subject (stratum) as the independent variable. The hypothesis that the percentage of TVI was the same in each of the four strata had a probability value[3/] of .001. Thus, distance from the subject would be significant at the .05 level.

3/ The probability value of a statistical test is the probability that a sample value will be as extreme as the value actually observed, given the null hypothesis.

Relationship Between TVI and Location

A One-Factor ANOVA was performed, with occurrence of TVI as the dependent variable and the office conducting the interview as the independent variable. The resulting probability value for the independent variable was .048, which would indicate that differences in location would be significant at the .05 level. The grand mean of the probability of TVI was .47; the deviation due to location was -.11, -.06, -.04, .05, .06 and .08 and the number of observations was 108, 39, 111, 96, 116 and 84 for Norfolk, Baltimore, Seattle, Buffalo, Kansas City and San Francisco, respectively.

Effects of Other Factors

Investigations were made to determine possible effects of various factors relating to the occurrence of TVI on the respondent's primary television receiver. A One-Factor ANOVA was performed with each of the following independent variables (probability values are in parenthesis): make (.015); age (.343); display capability (i.e., black and white/color) (.999); metal cabinet (.999); and solid-state (.077). Note that only the solid-state category was shown to have a significant (at the .10 level) effect on the likelihood of TVI. The grand mean for the likelihood of TVI in this test was .71, and the deviations were .03 and -.07 for the group of respondents with solid-state and non solid-state television receivers, respectively.

Effects of Directional Antenna and Linear Amplifiers

An examination was made to determine whether or not there was a significant increase in the percentages of respondents with TVI in those neighborhoods in which the subject was using a directional antenna and/or a linear amplifier. A Two-Factor ANOVA was performed, using the occurrence of TVI as the dependent variable and the subject's use of: (1) a directional antenna; and (2) a linear amplifier as the independent variables. However, the probability value for both of the independent variables was .999; therefore, no significant differences in the percentage of respondents with TVI could be shown between cases in which the subject had used a directional antenna and/or a linear amplifier, and those cases in which the subject had not. Note that in the Technical Survey the subject's use of a linear amplifier and a directional antenna had a significant effect on the likelihood of TVI. The differences between these two surveys can perhaps be explained by the fact that in the Technical Survey, interference was actually measured by the engineer (by a change in TASO grades) on the complainant's television receiver, while in the Neighborhood Survey, the engineers conducting the survey made no measurements, but rather, were forced to rely on the untrained respondent's subjective judgment as to whether TVI was present. In this respect the Neighborhood Survey data was less reliable.