signal at City B was about 45 dBmV, a signal with average power of 34 dBmV would have approached the limit of detectability by an aeronautical receiver. For a television picture carrier 34 dBmV average power corresponds to a peak power of about 39 dBmV (10^{-4} watts).

(10) The phenomenon of "phase addition" of cable leakage signals, as compared to addition on a power basis, was not observed and is not believed to be significant (Section 2.5).

5. PROPOSED REGULATORY APPROACH

.n view of the conclusions stated in Section 4.2, the Advisory Committee on Cable Signal Leakage recommends that the Commission adopt a new regulatory program for the control of cable television signal leakage. In some cases existing regulations should be maintained, but major modifications based on the research findings reported here are now in order. The Committee believes that a regulatory scheme based on the following points would adequately control the potential for airspace interference.

(1) In the aeronautical communications frequency bands, adopt signal leakage performance criteria for cable television systems. Allow use of any frequencies in those bands by any cable system showing that those criteria are met. (Exceptions may be appropriate near aeronautical emergency frequencies 121.5 and 243.0 MHz and the marine emergency frequency 156.8 MHz.)

(2) In the aeronautical radionavigation bands, adopt the same signal leakage criteria, but add a frequency restriction for any signal component having a peak power level greater than a specified threshold. Any such signal components should be restricted to frequencies which are odd multiples of 25 kHz (for example, 108.025, 108.075, 108.125 MHz, etc.), with a frequency tolerance of ± 5 kHz.

(3) The basic leakage performance criterion should be that the 90th percentile power output at the test signal frequency from an aircraft antenna such as that used in the research reviewed herein, at an altitude of 450 meters above the cable system, should be less than -100 dBm when the cable system is energized with an unmodulated test signal having power equal to the peak power of the highest cable television carrier within the VHF television bands.

(4) Direct measurement of the criterion of Item (3) is not usually feasible. Acceptable evidence that the criterion is met can be derived from any of several methods:

(a) Show that 10 log I_{3000} is equal to or less than -7, prior to carriage of signals in the aeronautical radio bands and at least once a year thereafter, based on a sampling of at least 75% of the cable strand, and including any portions of the cable system known or expected by the cable operator to have less leakage integrity than the average of his system.[35] The unmodulated test carrier should be within the VHF aeronautical radio bands, and at the level of the peak power of the highest signal component within those bands.

---

[35] It may require some care to specify in FCC Rules how the 75% to be covered must be chosen.

(b) Show that 10 log I_{∞} is equal to or less than 34, prior to carriage of signals in the aeronautical radio bands and at least once a year thereafter, based on a sampling of at least 75% of the cable strand, and including any portions of the cable system known or expected by the cable operator to have less leakage integrity than the average of his system. The unmodulated test carrier should be within VHF aeronautical radio bands, and at the level of the peak power of the highest signal component within those bands.

(c) Show by measurement in the airspace that the equivalent field from cable signal leakage does not exceed 10 microvolts per meter at an altitude of 450 meters above the average terrain of the cable system. The measurement system (including the receiving antenna) should be calibrated against a known field of 10 microvolts per meter produced by a well characterized antenna and ground plane at ground level. The half-power bandwidth of the detector should be 25 kHz or less. If an aeronautical receiver is used for this purpose it should meet the standards of the Radio Technical Commission for Aeronautics (RCTA) for aeronautical communications receivers. The unmodulated test carrier should be within the VHF aeronautical radio bands, and at the level of the peak power of the highest signal component within those bands.

(5) Measurements upon which calculation of I_{3000} or I_{∞} are based must either be made with a dipole and a field intensity meter as described in Section 76.609(h) of the Commission's rules or by means of another device which is calibrated in a realistic fashion against such a dipole and field intensity meter.

(6) The Commission should retain the authority to terminate cable system operation should harmful interference occur, independent of whether ground or air measurement criteria are met.

(7) Advance notification to the Commission of intended use of frequencies in the aeronautical radio bands, if maximum peak power is to be above the specified threshold, should be a continued requirement.

(8) The threshold cable system power level at which leakage integrity and frequency offset rules become applicable should be changed from the present 10^{-5} watts to 10^{-4} watts (38.75 dBmV, or -10 dBm). The threshold for notification of FCC should remain at 10^{-5} W (29.75 dBmV or -20 dBm).

(9) The existing requirement for regular and routine monitoring of any cable system using any frequencies in the aeronautical radio bands should be maintained.

(10) The upper allowable limit for individual cable leakage sources should be changed from the present levels to the level of 100 μVm as measured at 3 meters from the cable by the method now described in Section 76.609(h) of the Commission's Rules, independent of the frequency at which the leakage occurs. (This recommendation does not address interference to ground-based radio services or aeronautical receivers on the ground; however, even in that case the current 20 μV/m limit may be unnecessarily stringent.)

(11) Cable television systems which presently use aeronautical frequencies should be allowed either to continue complying with the existing frequency offset rules, or to meet the new requirements. This grandfathering period should terminate after a period of five to ten years. New users (and all users after the grandfathering period) must meet the new standards or avoid all use of the aeronautical radio frequencies.

ACKNOWLEDGEMENTS

The members and observers of the Advisory Committee wish to acknowledge the following non-Committee individuals and entities. Without their help, the research would have been considerably more difficult or impossible:

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Bridgeton, NJ	:	Garden State TV Cable Corp.
Coatesville, PA	:	Chester County Broadcasting Co.
Hagerstown, MD	:	Antietam Cable TV
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Raytown, MO	:	Community TV of Raytown Inc.
St. Joseph, MO	:	St. Joseph Cablevision
Salisbury, MD	:	General Television Inc.

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APPENDIX A

CHARTER

A. Committee's Official Designation

Advisory Committee on Cable Signal Leakage

B. Committee's Objectives and Scope of Activity

The function of the Advisory Committee is to advise the FCC on design and execution of research on prevention of radio interference due to signal leakage from cable television systems. The objective of the research is to determine the relationship between cable television system signal leakage as measured at ground level and the probability of interference to aeronautical and other radio services. The Committee will

- Advise FCC on the choice of cable TV systems to be examined, measurements to be made, methods of measurement, the form(s) in which data are to be recorded, and methods of analysis;
- Advise FCC in its monitoring of contract research which may be performed in this field;
- Suggest other research which may in the Committee's judgement be needed as the basis for FCC Rules to prevent cable TV leakage signals from causing interference to radio services; and
- Advise FCC on other aspects of cable TV interference as appropriate.

C. Period of Time Necessary for the Committee to Complete its Assigned Functions

Two years.

APPENDIX A

D. Official to Whom the Committee Reports

Chief, Cable Television Bureau

E. Agency Responsible for Providing Necessary Support for the Committee

Federal Communications Commission

F. Description of the Duties for Which the Committee Is Responsible

(1) Assist in designing the research program;

(2) Monitor progress of the research;

(3) Recommend areas for additional study.

G. Estimated Annual Operating Costs in Dollars and Man-years

$3,000 - $4,000

.15 man-years annually

H. Estimated Number and Frequency of Meetings

2 - 4 meetings per year

I. Committee's Expiration Date

Not Applicable

J. Date Charter Filed

February 10, 1978

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CABLE SIGNAL LEAKAGE

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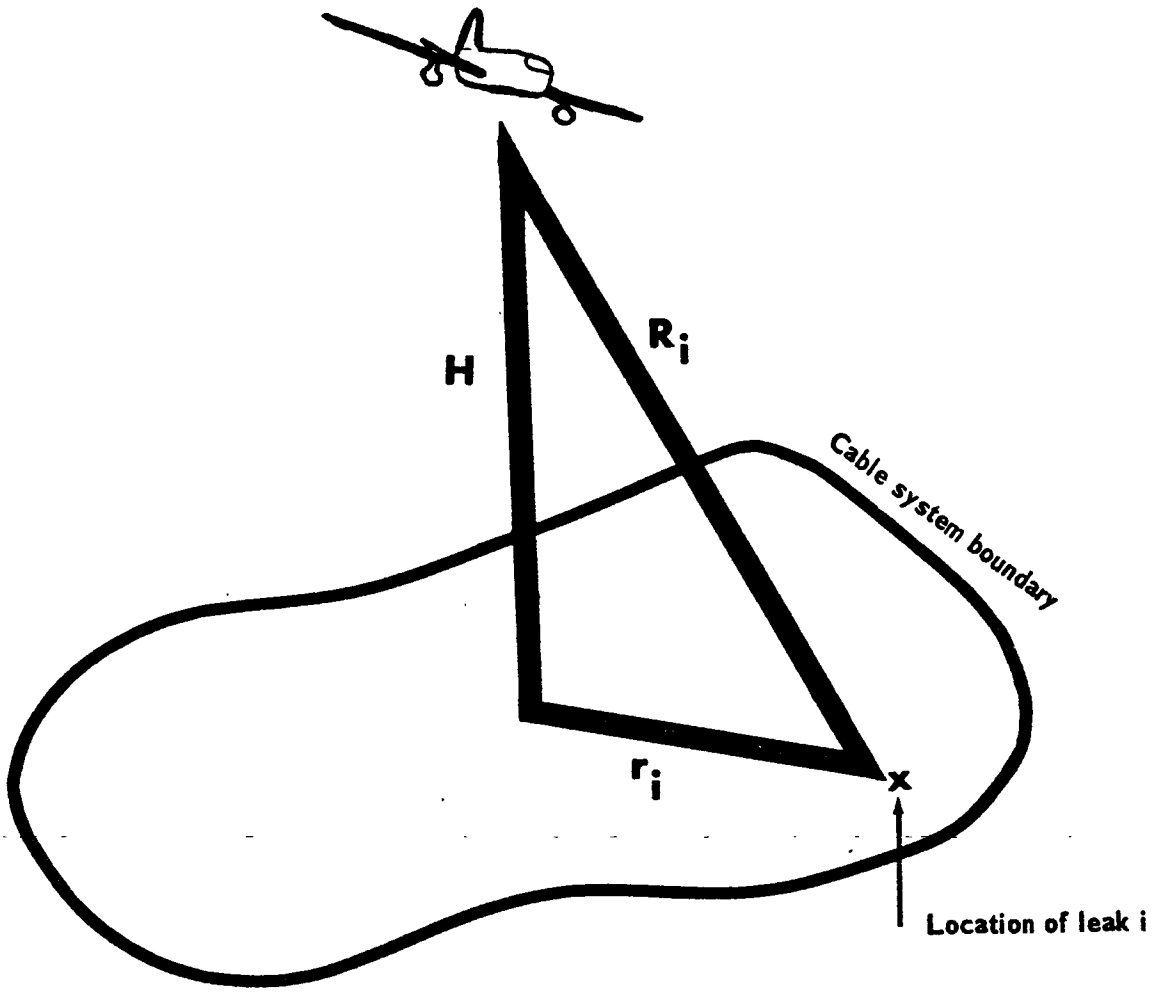

Figure H.15

Text: Section 3.5

APPENDIX B
TABULATION OF CITIES BY CITY CODE

City	Strand Miles	Subscribers	Leak Equip. Available	Terrain	% Pressure Taps	% RFI Connectors	Average Trunk Level dBmV	Average Distribution Level dbMV	Remarks	Vehicles with Leak Detector	Operator's Opinion of system
A	280	18,000	YES	FLAT TO HILLY	90	0	31	48	Constructed 1966	3	
B				HILLY							LEAKY
C	140	11,500	YES	HILLY	Several	Most	32	42	Oldest plant is 12 years with some only 7 years	1	AVERAGE
D	35	0	YES	FLAT	0	100		36	New Arlington, VA. No subscribers on cable plant tested		EXCELLENT
E	98	1,800	YES	FLAT	0	90	31	44	Constructed 1971	5	AVERAGE
F	53	2,500	NO	FLAT	Several	Few	12	52	Plant built in 1966, Some current rebuildings	0	LEAKY
G	320	14,000	YES	FLAT	0	5	32	45	100% rebuilt in 1972	7	AVERAGE
H	100	22,500	YES	FLAT	100	100	30	40	100% rebuilt in 1976	3	AVERAGE
I	366	11,800	YES	ROLLING HILLS	0	1	29	39	Constructed 1976	5	AVERAGE
J	108	2,800	YES	ROLLING HILLS	0	0	30	46	Constructed 1973	0	GOOD
K	90	4,500	YES	HILLY	0	?	32	45	Plant age varies between 1 and 10 yrs.	5	AVERAGE
L	100	1,700	NO	IN VALLEY	50	0	30	43	100% rebuilt between 1974 and 1976	0	AVERAGE
M	150	8,300	YES	ROLLING HILLS	0	10	30	45	Constructed 1972, with new additions	2	LEAKY

Text: Section 1.2

UNITED STATES GOVERNMENT

memorandum

DATE: March 24, 1978

REPLY TO ATTN OF: Chief, Enforcement Division

SUBJECT: Results of FOB, CATV Radiation Investigation

TO: Chief, Research Division, CATV Bureau
ATTENTION: Bob Powers

REFERENCE: 1120-A/77-W-357G

APPENDIX C

Text: Section 1.1.1

This bureau's investigation into CATV leakage, as measured on the ground, has been completed. Several systems were checked by engineers from our Kansas City, Long Beach, Miami, Norfolk, Philadelphia, and San Francisco field offices. The results of the investigaion are attached.

The instructions to the field offices indicated that only those leaks of at least 50 μv/m at 10 feet from the cable should be reported. Leaks were detected by cruising under the cable in the investigative vehicle while monitoring a frequency carried by the cable, but not used on-the-air locally. Particular attention was given to carriers in the band from 108-136 MegaHertz.

Cable systems were chosen as a matter of convenience to the participating offices. To conserve travel funds, those systems made readily accessible by other routine enforcement travel were chosen for this investigation. No system is uniquely identified in this report, as the purpose of the investigation was to establish overall trends, not to compare specific systems.

A total of 65 cable systems have been included in this report. Of those systems, no leaks were found in 13 systems, within the inspected mileage. Only 165 leaks of 50 μv/m or greater were found in the 1047 miles of inspected cable. The range of field strength values varies from the lower limit of 50 μv/m to a high value of 5600 μv/m.

The median field strength was 106 μv/m, while the values for mean and standard deviation were 205 μv/m and 610 μv/m, respectively. Even by removing the two abnormally large values (5010 μv/m and 5600 μv/m), the mean and standard deviation were 204 μv/m and 241 μv/m, respectively. The large standard deviations, relative to the means, demonstrate a large variance between individual systems that were sampled.

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Table I provides the percentage of leaks above the referenced value. Table II shows the percentage of systems with at least one leak in the referenced distance. Care must be exercised when extrapolating the information in the tables to cable systems in general, as the tables are valid only for this specific investigation.

TABLE I

PERCENTAGE OF LEAKS ABOVE REFERENCE VALUE

100 μv/m	250 μv/m	350 μv/m	500 μv/m	1000 μv/m	1500 μv/m
51%	24%	17%	12%	4%	1%

TABLE II

PERCENTAGE OF SYSTEMS WITH AT LEAST ONE LEAK IN THE REFERENCE DISTANCE

30 miles	10 miles	7 miles	5 miles	2 miles	1 mile
80%	68%	50%	35%	14%	9%

A summary of the data for each system is attached for your information.

Richard M Smith /ou

W. E. Ours

C