

## Cable Signal Leakage: Where is it all going?

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### ABSTRACT

Peaceful co-existence, that's the key! It has been more than a dozen years ago since cable television operators, in search of additional channel space, expanded into the frequency spectrum between television channels 6 and 7 (midband). During the same time period the Federal Aviation Administration (FAA) expressed concern about the potential problems associated with cable's usage of the midband and superbond (specifically the frequency bands between 108 - 136 MHz and 225 - 400 MHz). The cable industry's battle cries of: cable is a closed system, cable does not make airplanes fall out of the sky, and the FAA should police its own before coming down upon innocent cable operators, have all been heard. The pros and cons of the issue have been considered, but still there has yet to be found an acceptable solution to the problem.

By delving into the past, and looking at the present, the author will suggest a compromise solution for this troublesome problem that is going well into its second decade.

### INTRODUCTION

Cable Signal Leakage: Where has it been?, Where is it going?

Answering the above questions tactfully while maintaining a regulatory stance has not been easy for the Federal Communications Commission (FCC).

Nonetheless, because of the potential "safety of life" question associated with the cable signal leakage issue, the FCC must confront the issue and establish a workable regulatory policy.

Since the early 1970's, the FCC, the FAA, the National Telecommunications Information Agency (NTIA) and the Cable Television Industry, independently and collectively, strived to work toward a viable solution to the cable signal leakage dilemma. The results of the various experiments performed appeared to produce a satisfactory middle ground. However, at the most inopportune times, cable signal leakage related interferences would occur. Inevitably, these incidents would raise new questions which would result in a revisit of the compromise.

The last round of exchanges between the cable operators and the government regulators had been fierce with both sides determined to stand their grounds. The battle may be short lived, because despite the opposition, the Commission is compelled to rely upon the past performances of the cable operators to set the appropriate regulation on this sensitive issue.

### WHERE HAS IT BEEN?

The following is a summary of the history of events on cable signal leakage.

- 1971 - The FAA became concerned with cable's use of aeronautical navigations and aeronautical communications frequencies.
- 1972 - The Office of Telecommunications Policy (OTP) of the Department of Commerce ex-

- pressed their concern to the FCC. The OTP proposed usage restrictions on cable operators and at the same time commissioned the Institute of Telecommunications Studies (ITS), now National Telecommunications and Information Administration (NTIA), to investigate the concern.
- In the same year, the FCC initiated rule-making (36 FCC 2d, 143 (1972)) sans specific restrictions on cable operators. The FCC cited the lack of an actual interference report and the minimal interference probability as its reasons for not imposing restrictions.
- 1974 - The ITS issued its report demonstrating that various combination of events may result in interference to aeronautical radio users.
- 1975 - The FCC issued a public notice indicating cable's potential for interference to aeronautical usage.
- 1976 - First documented case of interference to aircraft frequencies discovered over Harrisburg, Pa. The cable operator was using the same frequency as the affected aeronautical channel and the cable system was not in compliance with the then existing FCC radiation limits.
- The OTP requested immediate action by the FCC to eliminate future occurrences.
  - The FCC released the first Notice of Proposed Rulemaking (NPRM), Docket 21006, (61 FCC 2d 1022 (1976)), on cable signal leakage interference prevention.
- 1977 - The OTP responded to the FCC on the NPRM. In its comments, the OTP didnot request the cable operators to vacate the aeronautical radio bands while studies of the problem is underway.
- In its comments, the FAA requested the ban of all cable operations in the aeronautical bands until adequate rules were developed and more importantly, were enforceable.
  - The FCC adopted the interim rules (47 CFR 76.610 -76.613). The rules did-
- not ban cable usage within the aeronautical bands but did required distance separation and frequency offset by cable operators in those bands.
- 1978 - The interim rules became effective.
- The Advisory Committee on Cable Signal Leakage were formed to investigate the issue. The committee comprised of the FCC, FAA, NTIA, cable industry representatives and private aviation interest groups.
  - Second documented case of interference from cable leakage occurred over Hagerstown, Md. It was an on-frequency interference to an identification channel of a VHF Omni-Range (VOR). The cable system was in violation of the interim rules and didnt meet the FCC's radiation limits.
  - Third documented case interference to a low altitude en route communications channel over the vicinity of Oxnard and Ventura, Ca. There was no frequency separation between the cable frequency and the air-communications channel. The cable operator was again in violation of the interim rules and the established radiation limits.
- 1979 - Fourth documented case of interference occurred over Wilmington, NC to an approach control communications channel. This was also an on-frequency interference from the cable system. The system was in violation of the interim rules and exceeded the Commission's leakage standards.
- The Final Report of the Advisory Committee on Cable Signal Leakage was released.
- 1980
- Mar - Based upon the conclusions of the advisory report, further NPRM (Docket 21006) was released by the FCC for comments.
- Sep - The comments on Docket 21006 were completed.
- Sep - Fifth documented case of aeronautical interference occurred in a high altitude (25,000-40,000 ft) en route sector within the vicinity of Flint, Mi. The cable frequency used was not offset from the air communications channel. Once again, the cable system was not in compliance with the FCC's Rules.

- Dec - The FCC's Cable Television Bureau (CATV Bureau) enacted forfeiture procedures on signal leakage from cable systems.
- 1981
- Feb - The FCC amended its interim rules to forbid cable usage of aeronautical frequencies without prior clearance by the Commission.
- Feb - The CATV Bureau directed the FCC's Field Operations Bureau (FOB) to randomly inspect cable systems nationwide for compliance with the interim rules.
- Feb - The CATV Bureau requested assistance from the Data Automation Division (DAD) of the Office of Managing Director and the Office of Science and Technology to formulate an aeronautical frequency notification processing system (AFP-CABAL).
- Mar - The enforcement branch of the CATV Bureau directed numerous cable operators to vacate channels already in use within the aeronautical bands until compliance with the rules has been met.
- Apr - FCC fined three cable systems a total of thirty seven thousand and five hundred dollars (\$37,500) for violations to the interim rules and the radiation standards.
- Aug - Initial AFP-CABAL system completed.
- Nov - The FOB was directed to step-up the cable inspections program on aeronautical frequency usage.
- Nov - The American Radio Relay League (ARRL) and numerous other amateur radio groups filed complaints of interference to their bands by cable operators to the FCC.
- 1982
- Jan - A petition for rulemaking was filed by the ARRL. Within the petition, the ARRL requested the prohibition of cable operation on the Amateur Radio Service frequencies (HAM).
- Mar - FCC released rulemaking RM-4040 in reply to the ARRL petition.
- Mar - The draft action plan to automate AFP-CABAL approved.
- Aug - The FAA requested the FCC for assistance to investigate the source of interference to an Instrument Landing Station (ILS) in Florida. The interference had rendered the ILS inoperable for approximately forty five (45) days. The interference was not pinpointed to cable signal leakage, but did mischievously disappear when the local FOB field office queried the surrounding cable systems on aeronautical frequency usage.
- Oct - A cable system in California was fined for excessive leakage and interference to area HAMS.
- Oct - Various cable systems in California was requested to vacate cable channel H in view of interference to a fire patrol frequency used by the Forestry Service.
- Nov - CATV Bureau requested the FOB to perform Phase II inspections and continue enforcement of the cable signal leakage program.
- 1983
- Jan - FCC wanted to go forward on Docket 21006 with changes.
- Apr - AFP-CABAL system ready for testing and subsequent implementation.

#### WHERE IS IT NOW ?

#### FCC Rules

At the present time, cable operators have to abide by the following FCC Rules and Regulations.

Section 76.605(a)(12) (47 CFR 76.605(a)(12))  
Technical Standards.

- a) radiation limit of 20 microvolts per meter at ten feet for frequencies from 54 - 216 MHz.
- b) for all other frequencies, the limit is 15 microvolts per meter at 100 feet.

Section 76.609 (47 CFR 76.609) Measurements

- a) methods and procedures for radiation measurements.

Section 76.610 (47 CFR 76.610) Operation in the Frequency Bands 108 -136 MHz and 225 - 400 MHz.

- a) applicable to all carriers and subcarriers with peak power levels of 10 microwatts (28.75 dBmV) or above on the cable distribution system.
  - 1) cable operator must notify Commission annually of all frequencies carried.
  - 2) clearance of frequencies must be obtained

prior to carriage on cable system.

- 3) Cable operator must monitor and maintain a leakage log encompassing the entire system once a year.
- 4) Cable systems within 60 nautical miles of aeronautical radio stations must have the following offsets:
  - a. 100 kHz + tolerance (T) in the air communications bands (118-136 MHz, 225-328.6 MHz and 335.4-400 MHz).
  - b. 50 kHz + T for the air navigational bands (108-118 MHz and 328.6-335.4 MHz).
- 5) If an assignment of an aeronautical radio frequency occurs within 60 nm of the cable system (drop-in), the cable operator would have thirty (30) days to resolve the new conflict.

Section 76.611 (47 CFR 76.611) Operation Near Certain Aeronautical and Marine Emergency Radio Frequencies.

- a) cable carrier frequencies greater than ten microwatts are prohibited:
  - 1) within 100 kHz of the universal S.O.S. frequency 121.5 MHz.
  - 2) within 50 kHz of the two emergency frequencies 156.8 and 243.0 MHz.

Section 76.613 (47 CFR 76.613) Interference from a Cable System.

- a) definition of harmful interference
- b) responsibility of cable operator to eliminate the harmful interference.
- c) Engineer In Charge (EIC) of the local field office may issue a "cease and desist" order in situations of "safety of life" and protection of property.

#### Waiver of Section 76.610 (47 CFR 76.610)

At the time of the writing of this paper, the FAA has indicated that they probably would not object to a waiver of Section 76.610 of the FCC's Rules if the following criteria were met.

- a) the proposed usage is at least 10 nm outside the service volume of the aeronautical radio station.
- b) the frequency offset is at least 30 kHz and the cable frequency stability is maintained at 5 kHz or less.

#### FCC Compliance

The vigorous enforcement of the reporting criteria of Section 76.610 of the rules began shortly after September, 1980. This step-up in enforcement activity was in response to the claim of the FCC's lack of enforcement of the aeronautical rules coupled by the earlier interference events.

The enforcement actions included two types of inspections (Phase I and Phase II). A Phase I inspection is described as a "paper inspection" by the FOB inspectors. In a Phase I inspection, FOB field offices are directed to randomly select cable systems for inspection. The inspectors would visit the cable systems and ask whether the system is operating in the aeronautical bands. If the system is using aeronautical frequencies, they are requested to produce documentation which would satisfy Section 76.610 of the rules. If documentation cannot be produced, the cable operator would be made aware of the violation. The inspector would be recording the usage and would submit the report to the Enforcement Branch of the CATV Bureau for forfeiture actions. While the inspectors are at the system, they are also to check for compliance with other areas of the cable rules (e.g. radiation leakage). In a Phase II inspection, the FOB inspector would actually "walk" the system and measure for leakage along the cable plant. The results are again forwarded to the CATV Bureau for follow-up actions. Usually, a Phase II inspection is selected at random by the individual field offices. However, these inspections could also be a result of an earlier Phase I inspection or triggered by complaints on the cable system.

In 1981, FOB inspected over 180 cable systems for Phase I compliance. A review of the reports indicated the following: twenty eight percent (28%) of the systems inspected that were operating within the aeronautical bands did not report their usage to the Commission, twenty seven percent (27%) of the cable systems were not using the critical frequencies, and thirty percent (30%) of the system had complied with the reporting criteria as required by Section 76.610 of the rules.

In 1982, 285 Phase I inspections were conducted by the FOB field offices, the results of these inspections indicated that eleven percent (11%) of the

the cable systems still didnot comply with the reporting criteria of the rules, thirty four percent (34%) were not using the aeronautical frequencies and fifty five (55%) percent had reported usage.

Since the middle of 1981, there had been approximately forty Phase II inspections conducted by the FOB field offices. The resulting data indicated that only six percent (6%) of the systems had little or no leakage. Conversely over thirty four percent (34%) of the cable systems measured had leaks that would result in cumulative leakage indices of greater than 64 (refer to the Final Report of the Advisory Committee on Cable Signal Leakage released in 1979). If we were to draw our conclusion from the report, these cable systems would have a ninety percent (90%) chance of causing "harmful interference", as defined in the same report, to aircraft flying at altitudes of 1500 feet.

Since the intensification of the FOB inspections, approximately 600 cable operators had voluntarily disclosed their violation of the notification requirements in hopes of expeditious processing on their frequency usage notifications. Of these 600 disclosures, at least seventy percent (70%) had to vacate certain channels within the aeronautical bands at one time or another. During that same time period, there had been close to two thousand (2000) waiver requests for frequency offset requirements of the Rules.

Up until now, the Commission had levied fines for violation of the interim rules and leakage standards to sixteen (16) cable systems. These fines total to one hundred twenty five thousand dollars (\$125,000).

#### The Aeronautical Frequency Processing System (AFP-CABAL)

The AFP-CABAL system was originally designed to handle the voluminous number of notifications which the then CATV Bureau had to review for aeronautical conflicts. However, the exponential increase in the number of notifications and the retention of the manual files had became too tedious for the limited staff. The automation of the AFP-CABAL system would relief the laborious tasks associated with the up-

keep of the aeronautical files. In addition, it would serve to complement the enforcement actions as well as give rapid responses to the various agencies that from time to time requested assistance on these cable aeronautical matters.

The main objectives of the automated system is as follows:

- a) maintain a data base of all aeronautical notifications and their related actions.
- b) generate responses for all aeronautical requests.
- c) allow users to rapidly retrieve and/or update information.
- d) permit other users access to selected information. Initially, the other FCC Bureaus and the FAA, then access on a limited basis will be available to the public.
- e) automatically process aeronautical frequencies used by cable systems within the data base against changes in assignments by the FAA or DoD (drop-ins) and notify operators of the new conflicts.
- f) ability to generate statistical reports as needed (e.g. so the author does not have to tabulate through the paper files as he did on this paper).

The extension of the AFP-CABAL system would ensure the other regulatory agencies and indicate to cable operators of the FCC's commitment for continuing monitoring and enforcement of the FCC's cable aeronautical rules.

#### WHERE IS IT GOING ?

According to statistics compiled from information filed by cable operators on FCC Form 325, as of October, 1982, there were 470,000 strand miles of cable in this country. From the same set of data, the total number of reported cable systems amounted to 5100 serving over 12,000 communities. Of these 5100 cable systems, about one-third of them indicated the use of aeronautical frequencies.

These numbers would most certainly increase as the cable television industry heads into a rebuilt period. The rebuilt systems are likely to utilize frequencies within the aeronautical and amateur radio bands. As the number of cable users in these bands

increase, the likelihood of interference are also bound to increase. If cable operators are not careful, the over-the-air user groups can and will exert tremendous pressure on the Commission to ban cable operators from venturing into their frequencies. Cable operators should recognize that they are the secondary users and not the other way around. The FCC's rules at this time require cable operators to eliminate harmful interference if and when it occurs. Until cable operators can prove themselves a "closed system", they will have to appease their over-the-air counterparts. The Commission will most likely never entirely ban cable's use of the troublesome frequencies but it can make it more difficult rather than easier for cable operators.

#### Compromise Solutions

The issue of cable signal leakage interference to over-the-air users should be broken into two separate parts. The first and more important portion is aeronauticals and cable. It appears that all the documented cases of aeronautical interference occurred without any frequency offset between the cable carrier used at the time and the aeronautical channel. It also seems that all the cable interfering carriers are either visual or pilot carriers with peak power levels in excess of 100 microwatts (38.75 dBmV). I believe the operation of cable carriers within the aeronautical bands will probably not be a problem if the cable carrier frequencies are at all times at a constant frequency offset from the aeronautical channels (the FAA and DOD channel assignments are usually 25 kHz apart). If this offset is kept constant, then the threshold power levels can be increased to 38.75 dBmV. This will eliminate more than half of the concerned cable carriers (e.g. aural and data carriers). The best incentive of all, cable operators can lose their constant fear of drop-ins by the FAA or DOD.

There is at all times an offset from the new assignments. Of course, more frequent and more diligent monitoring by cable operators will ensure the "closed system" that cable should be.

The second portion is cable and the other over-

the-air users. This issue should not be too difficult to handle if the diligent monitoring program is maintained by cable operators. Outside of keeping the cable system tight, better cooperation with the over-the-air users (especially the HAM's) will most likely to relief the present hostility between the various groups.

#### CONCLUSION

Peaceful co-existence between cable operators and their over-the-air counterparts can certainly be a reality provided cable operators are willing: to keep their systems tight, are willing to "give in" and slightly offset their carrier frequencies within the critical bands, and finally "talk to" and cooperate with other users on interference prevention and elimination.

#### ACKNOWLEDGMENTS

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Note: Opinions and suggestions which were discussed in this paper were those of the author alone, and did not necessarily represent the position of the Federal Communications Commission.