Computer analysis of intermod requires a pragmatic approach A prescription for an effective computer program to calculate intermod includes practical and user-friendly techniques for entering and analyzing data.

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Mobile Radio Technology, Sep 1, 1996

Some good programs for calculating intermodulation interference (intermod) are available, and most people with technical responsibilty for communications sites keep at least one program available on their computer. Unfortunately, many programs seem to be "user-antagonistic."

Some programs in DOS do not permit making a correction to a frequency that was entered incorrectly; you have to start all over again. Many perform endless calculations of frequency combinations and multiples that are entirely unlikely to produce intermod at any measurable level. Most programs fail to permit the user to tag the frequencies to make it possible to identify the licensee. Even so, any computer program beats the old days of performing the whole study by hand calculator or even by slide rule. Remember slide rules? I still have one. It props up the laptop computer on my desk!

Most programs ignore the fact that a station with several frequencies can only transmit or receive on one frequency at a time. These studies show combinations of two or more such frequencies transmitting at the same time and generating intermod products, which obviously cannot happen. This causes a lot of computer output that must be hand-checked and discarded.

Some programs calculate 5th-, 7th- or even higher-order intermodulation products. Experience shows that these higher-order products rarely cause problems, except with antennas that have little isolation or with old equipment or high power levels. The choice of using the higher-order combinations should be left to the program user.

It would be difficult to include all of the operating characteristics of a shared site, such as power output, effective radiated power (ERP), radio model names and numbers, types of filtering and isolation figures between antennas.

The proximity of intermod product frequencies to the receiver frequency is given in some studies as 0.010MHz, 0.025MHz or 0.050MHz. Other, larger values are used for FM and TV broadcast frequencies. Modulation levels may vary between narrowband FM and FM broadcast, as well as some of the more exotic forms of modulation, and these modulation levels should be part of the study.

Some services such as public safety two-way radio, specialized mobile radio (SMR), community repeaters and paging often are in heavy use during the working week. Others, such as rural fire departments, fish and game departments, forestry and agricultural services are used lightly, as well as seasonally. The difference in operating patterns implies that, although intermod interference can occur between some systems, there is not necessarily a statistically significant likelihood that it will occur.

An intermod analysis should realistically weigh the frequency and severity of radio interference against actual harm to the public welfare. For example, frequent occurances of intermod (called "hits") that affect a state police receiver would be considered unacceptable, yet occasional background noise on the radio system used by a towing service might cause less concern.

In any study, each frequency should be tagged with a short identifier to make it possible to recognize the user. There should be a summary showing the interfering transmitter combinations and the receiver being affected, including the frequency separation between the receiver and the intermod product. If some information on system-use cycles, ERP and antenna isolation were to be included in the study, the summary might include estimates on the probability that interference would occur. I have a site with a 1W broadcast translator and a 1kW broadcast transmitter that use antennas on the same tower. Power differences of that sort should be considered in any intermod study.

For the benefit of someone entering data to run an intermod study, it is important to be able to correct an incorrectly entered information, or to save the work in progress and exit the program (without invoking DOS scriptures) to come back to it later. A busy site may contain dozens, if not hundreds, of frequencies, and data entry takes a lot of time.

A program should be capable of examining the effects of all transmitters on a single receiver.

Above all it should be "user-friendly," and easy to store, so later studies can be done without re-entering masses of data.

Ideally, the study results should be evaluated by someone with a knowledge of the site and its individual systems, someone who knows whether circulators, isolators and combiners are in use, and who knows the general level of "housekeeping" and adherence to site rules. This individual must be able to make recommendations for any filtering or technical changes that may be needed. The summary or final report of the study must be brief and readily understandable because these documents sometimes are used, for better or worse, by non-technical people.