Lab Notes

Conducted By Steve Ford, WB8IMY, Assistant Technical Editor
and the ARRL Laboratory staff.

Interference Primer—Part 1

This month Ed Hare, KA1CV, Senior Laboratory Engineer, grapples with one of the most difficult problems in Amateur Radio: electromagnetic interference, or *EMI*. EMI is a catch-all term for TVI, RFI, BCI and any other form of electromagnetically generated interference. Regardless of the terminology, the ultimate translation is *trouble!—WB8IMY*

You may find this hard to believe, but nearly every person in the technically developed world has experienced EMI. At the ARRL Laboratory we receive telephone calls and letters on the subject of EMI *every day*.

Let's start by defining the term *interference*. To some people, it implies action and intent. The statement, "You are interfering with my telephone," sounds like an outright accusation, doesn't it? For our purposes, let's define interference as *any* unwanted interaction between electronic systems—period. No fault. No blame. It's just a condition.

Whenever I host an EMI technical forum at ARRL conventions or local club meetings, I always conduct an informal survey. I ask the members of the audience to raise their hands if they've ever had an interference problem. I can always count on a 30% response, and most of the elevated hands belong to individuals who've experienced some form of interference involving their ham stations.

After taking a quick tally, I carefully explain that interference caused by electric motors, power lines, CATV leakage and spurious emissions from consumer devices must be included in the definition—as well as interference to *their own* consumer electronics equipment from *all* of these sources. When I see the looks of enlightened surprise, I know it's time to repeat my survey. Before I even finish asking the question nearly every hand reaches for the sky!

So, now that I've convinced you that you may have a problem (as if you really needed convincing), let's move on to the questions and answers.

Q: My new neighbor just knocked on my door and said that my signals are tearing up his TV and telephones. He threatened to call the FCC if I didn't stop transmitting. Am I in serious trouble? What should I do?

A: I wish I could give you a long list of technical solutions, but we have to save that until next month. Why don't we indulge in a bit of psychology first? Hams are great communicators over the airwaves, but some of us need practice when it comes to communicating face-to-face.

You can't overestimate the importance of personal diplomacy when you're confronted with an EMI problem. The way you behave when your neighbor comes knocking sets the tone for everything that follows. No matter what you think of your neighbor, you have to remember that the best solutions are built on cooperation and trust. Knowing all the technical tricks in the book won't do you a bit of good if your neighbor won't let you through the door!

Q: I don't know... he seems pretty angry. What can I tell him?

A: It sounds like your neighbor has already branded *you* as the villain. He's angry and fully expects you to respond with denials and evasions. Don't do it!

Begin by accepting the fact that he doesn't enjoy having his lifestyle hampered by EMI. Put yourself in his shoes. Admit that EMI *is* highly annoying. (Both of you can quickly agree on that point!) Calmly explain that you are responsible—by law—for the proper operation of your station. Assure him that you'll check your equipment right away and make any necessary corrections.

Until the problem is resolved, try making some goodwill gestures. As a temporary measure, reduce your output power. (You may discover that you didn't need all those watts anyway!) If you have a beam antenna, don't point it at your neighbor's house. Above all, try to gain some perspective on the situation. Amateur Radio may be your passion, but doesn't mean a thing to him. Attempting to justify EMI by saying, "There was this rare DX station on 10 meters and I just *had* to work him, won't get you very far with an irate neighbor.

Q: If I'm not a source of the problem, why should I feel obligated to help?

A: By helping him solve the problem, you'll be making a friend, not an enemy. What if, sometime in the future, you buy that new amplifier and start calling *CQ* when it's third down at the goal line with 30 seconds left in the game. If you blitz your neighbor's TV, he may be more understanding and less likely to do something rash.

Q: I don't feel confident to call myself an EMI expert. How can I get some help?

A: Your ARRL Technical Coordinator (TC) is the first person to contact. The TC often has a cadre of assistants (Technical Specialists) available, and there may be one near you. If you have local clubs with EMI or TVI committees, they usually coordinate their activities through the TC. The TCs often have liaisons with local utilities such as cable companies. Knowing the right individual to contact may prevent a CATV repair person from pointing at your antenna and telling your neighbor, "It's all his fault."

Some people choose to call the TC only as a last resort, waiting until all diplomatic and technical solutions have failed. This is a bad idea! The TC is a volunteer and may choose not to participate in a situation that has deteriorated badly. Most of them prefer to be involved right from the start. They are often skilled (read: *practiced*) in the art of EMI negotiations.

Q: Okay, I'm convinced. How do I find my TC?

A: The easiest way to find your TC is to ask your ARRL Section Manager. Section Managers (SMs) are listed on page 8 of any recent *QST* issue. Most SMs include their telephone numbers, but be considerate. Call during the day or early evening. You can also call ARRL Headquarters to ask for the name of your TC, but we do not divulge telephone numbers.

Q: The TC, my neighbor and I all want to know the source of the problem. What should we do next.

A: Offer to arrange a test. Ask your neighbor to invite a friend to visit your shack during the test. In addition, ask your neighbor if it would be possible for one of *your* friends to monitor the test at your neighbor's home. Having impartial witnesses will make you and your neighbor more confortable with the outcome—whatever it may be.

Be sure to choose your witness carefully. Select someone who is known for diplomacy and tactfulness.

Your test must be *thorough*. Transmit on every band and mode you normally operate. If you have a beam antenna, aim it in different directions while transmitting. Try various power output levels, too. Ask your friend to keep detailed notes of the results. (A radio or telephone link between you and your friend would come in handy during the test.) Even if your test proves that your station is blameless, don't just drop the problem in your neighbor's lap and say, "Good luck!" Offer to help him find a solution.

Even though it's not a legal requirement, it's a good idea to keep a detailed station log. Now that you're involved in an interference issue, it's a necessity! You should ask your neighbor to keep notes, too. Ask him to identify which piece of equipment experienced the interference, what channels or frequencies were involved, the date and

time the interference occurred and how severe it appeared to be.

Q: Can I expect any help from electronic equipment manufacturers?

A: One prominent manufacturer program is a contact data base that's maintained by the Electronic Industries Association, 2001 Pennsylvania Ave NW, Washington, DC 20006, tel 202-457-4977. When you have an interference problem with a piece of consumer electronic equipment, write or call the EIA to determine who you should contact for assistance. The EIA also keeps a record of each report. (The EIA prefers that you write rather than call. The details of a problem can often be communicated more clearly in written correspondence.)

You may be surprised to know that the number of reported cases of interference to consumer electronic equipment in recent years has been very small. This is *our* fault! Amateurs are notorious for not reporting EMI problems. Contact the EIA! Working with manufacturers keeps up the pressure to continue development of better shielding and filtering methods. It also demonstrates to your neighbor that the *manufacturer* should receive a little of his anger and frustration too!

Q: But my neighbor's problem isn't limited to TVs. What about his telephones and other audio devices?

A: In almost all cases, interference to an audio device is caused by detection of your fundamental signal, just like a crystal detector radio receiver. Your detected signal gets amplified along with the desired voice or music signal.

This is clearly not the fault of the transmitting station. The *FCC Interference Handbook,* available free of charge from the ARRL Regulatory Information Branch here at Headquarters, states on page 18:

> "Telephones, stereos, computers, electronic organs and home intercom systems can receive interference from nearby radio transmitters. When this happens, the device improperly functions as a radio receiver."

The FCC clearly puts the responsibility for interference to audio devices on the manufacturer. Most manufacturers respond appropriately if contacted about consumer EMI. As I said previously, contact the EIA and they'll help you find the right person to write or call.

Q: In spite of my efforts, and the diplomatic skills of the Technical Coordinator, my neighbor must have called the FCC; I just got a letter from the local FCC Field Office. What now?

A: Well, you could sell all of your equipment, cancel your license and take up basket weaving...or you could sit down and answer the notice! The exact FCC response to consumer-interference complaints varies among the different Field Offices, but they use similar steps to resolve interference cases.

You already have the first step in hand. Your letter from the FCC Field Office is stating that you and your neighbor are involved in a mutual problem. I hope both of you will get the message the FCC is trying to deliver—that it's in your best interests for *you* to find a solution that's acceptable to everyone. Your TC, acting as a third party, may be able to help you with the technical and interpersonal aspects of the problem.

The first order of business is to answer the FCC letter as accurately as you can. If you've offered to cooperate with your neighbor and were turned away, say so. If your TC has been helping you solve the problem, explain what the TC has done and what conclusions have been reached. The FCC is interested in hearing that your station is grounded (even though a station ground is *not* a cure-all for EMI!) and that your station is well-designed. Tell the FCC whatever you think is important to the proper resolution of the case. Try to minimize emotional comments, extraneous data and fluff.

If the FCC is satisfied with the answer, or if you and your neighbor find a solution, the case is closed. If not, the next steps are a bit more drastic. The FCC may inspect your station. In extreme cases, *quiet hours* may be imposed, limiting the times of day you are allowed to operate. The mere thought of quiet hours should give you plenty of incentive to cooperate fully with the FCC!

Q: Well, I've found some local helpers and they're really making progress. I'd like to know more about EMI. (I might want to offer assistance to another unfortunate ham someday.) Where can I learn more about EMI?

A: Reading this column is a good start. We can't teach everything about EMI in a few pages, but we'll provide some important highlights. Several good books on the subject are readily available.

The best one is the ARRL's *Radio Frequency Interference: How to Find It and Fix It.*[1] It was written by a number of authors ranging from ARRL Technical Coordinators to EMC (electromagnetic compatibility) engineers. The book covers EMI fundamentals and troubleshooting as they apply to transmitters, receivers, TVs (VCR and CATV), telephones, computers, audio devices and automobiles.

William (WA6FQG) Nelson's *Interference Handbook* is an excellent volume to add to your collection.[2] Nelson is a former RFI investigator for Southern California Edison Electric Company. It should be no surprise that his book is especially strong in the area of power-line interference.

Over the years, most Amateur Radio magazines have published articles about EMI. These articles, including some classics from the 1950s and 1960s, are informative reading. A bibliography of *QST* EMI articles is available from the ARRL Technical Department Secretary. Many *QST* back issues are available from our Publication Sales Department at the current cover price. Photocopies of League publication articles are available from the Technical Department Secretary for $3 each. Contact ARRL Headquarters for information about these League services.

Q: I've had enough of the preliminary stuff and I'm eager to learn more about the technical side of EMI. When do we start?

A: I don't know how to break this to you, but we've run out of page space. As we said at the beginning, this is going to be a two-parter! Instead of making you wait two months, however, we're going to modify our format and continue this topic in the March issue. (We were having so much fun, we decided to do the column two months in a row!) So think about the important start we've made here, talk about EMI on the air and wait until March to hear the rest of the story.—*Ed Hare, KA1CV, Senior Laboratory Engineer*

Notes

[1] *Radio Frequency Interference: How to Find It and Fix It* is available from your local dealer or direct from ARRL HQ. See the ARRL Publications Catalog elsewhere in this issue for ordering information.

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We welcome your suggestions for topics to be discussed in *Lab Notes*, but we are not able to answer individual questions. Please send your comments or suggestions to: Lab Notes, ARRL, 225 Main St, Newington, CT 06111. QST

Strays

***QST* congratulates...**

☐ Bill Murphy, WA6CMJ, on being named the Air Force intelligence community's Civilian Security Officer of the Year. Murphy is chief of security for the Air Force Intelligence Training Center at Goodfellow AFB in San Angelo, Texas.—*Noel Johnson, KE5NO, San Angelo, Texas*

☐ ARRL Life Member Will Connelly, W6QID, of Ft Lauderdale, Florida, on being appointed a member of the National Oceanic and Atmospheric Management Advisory Committee by US Secretary of Commerce Robert Mossbacher. Connelly was also recently appointed to the Nova University Oceanographic Center (Ft Lauderdale) Board of Governors. He serves on the National Oceanic and Atmospheric Administration Fleet Modernization subcommittee.