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TACKLING SERIOUS INGRESS

By RON HRANAC

Those of you who read this column regularly know that I'm a ham radio operator. I've written about ham radio-related interference in the past, most recently in the April 2003 issue (http://www.broadband-pbimedia.com/archives/ct/0403/0403_broadband.html). Here's an interference story you may find enlightening.

A couple months ago one of the upstreams in a Midwestern cable system was suffering from some rather nasty interference. The system's telephony service was affected, yet high-speed data seemed for the most part to work just fine with only occasional glitches. The culprit appeared to be upstream laser clipping, yet nothing in the 5-42 MHz band looked particularly out of whack. Until, that is, system personnel looked below 5 MHz and found very high-level ingress at 3.77 MHz.

The interference turned out to be coming from a ham radio operator who lives a few blocks from the affected node. The ham was operating in the 80-meter amateur band at the FCC-authorized legal limit of 1,500 watts peak envelope power (PEP). Whenever he transmitted, his signal was strong enough to clip the upstream laser. As one would expect, cable modem traffic continued to work fairly well, because the data will be retransmitted until it gets through. Not so with voice-if voice packets don't make it through the first time, they're gone for good. The system's voice service in the neighborhoods served by the affected node was hit pretty hard.

You might be inclined to think that the problem is the ham operator. Not so. He is licensed by the FCC for over-the-air transmissions and is operating perfectly legally. The real issue is that his signal was somehow getting into a supposedly shielded cable network. Eliminate the ingress path, and the interference should subside.

"Wait a minute," you argue. "How can anyone possibly keep 1,500 watts of RF out of the upstream?"

Good question.

Finding the ingress source

System techs first drove out the area around the ham's house, finding and fixing a handful of leaks in the 15 to 20 microvolts per meter (V/m) range. That had little, if any impact on the interference. Techs even tried using a 4-watt citizens band radio as a means of identifying points where ingress was entering the return path, and that had mixed results. (A quick side note: While some cable operators successfully use handheld or mobile CB radios for this purpose, it is technically not a legal use of those radios.) In correspondence with one of the system techs, I offered the following thoughts:

"You may need to do some signal leakage detection in the affected area (probably a few blocks' radius) with much more sensitive leakage detection equipment than you're now using. You might ask the ham operator if he has a 2-meter transceiver that he would mind monitoring cable channel 18's visual carrier frequency (145.25 MHz) within the neighborhood to see if ANY very low level leakage can be detected. Most modern 2-

meter transceivers have ham band sensitivity of around 0.16 microvolt, which is something on the order of -75.9 dBmV.

"A good external antenna with gain-say, a three- or four-element Yagi-will help pinpoint very low level leaks using the 2-meter radio as the leak detector. I suspect you may find cable-ready TVs and VCRs, a few loose F-connectors, maybe a loose tap plate or two as the combined culprits allowing the amateur's shortwave signal into the cable system's reverse path.

"You may find that it is necessary to use tri- or quad-shield drop cable in homes around the ham operator, along with premium sealed F-connectors. As well, high-pass filters may be helpful on one-way drops, and on the TV side of the drop splitters feeding cable modems in the area. Common mode chokes may be necessary in some cases, and may help on the power cords of some set-tops or modems. The ham may be familiar with common mode chokes-if not, let me know and I'll pass along a few tips."

About this time the cable company's Senior RF Engineer David Haigh (a ham operator himself) returned from a business trip. David encouraged his techs to keep working on finding and fixing low-level leaks. Fortunately the ham operator proved to be a very cooperative individual, and he volunteered to drive around the area and transmit with a mobile shortwave transmitter. His mobile setup is capable of several hundred watts, which made it fairly easy for system personnel to identify all sorts of low-level ingress points within about a six-block radius of the ham's house.

Small problems add up

What they found was really no surprise: loose or corroded (usually fairly old) F-connectors; a few loose hardline connectors and splices; loose faceplates in feeder passives (taps and line couplers and splitters); and a handful of bad drops. The techs replaced those bad drops and several in the immediate vicinity of the ham's house with tri-shield cable. They found that low-value taps were especially susceptible to interference from the ham's transmitted signal. Mind you, none of these problems was enough to cause leakage in excess of the FCC's 20 V/m limit. Indeed, even the system's tagged signal leakage detection equipment often identified only the occasional low-level leak.

To make a long story short, system techs were successful in eliminating all of the interfering ingress getting in on one feeder leg connected to the affected node, and reduced it substantially on the other leg. There wasn't any one ingress point that was allowing the ham's signal to get into the cable network's upstream. It turned out to be the combined effects of several low-level points. The upstream laser is no longer clipping, and the voice service is working the way it's supposed to. As Haigh put it, "Those upstreams are really clean now, and I don't hear a peep out of our leakage detection equipment when driving through the neighborhood. Our system techs really got some valuable experience from this."

Ron Hranac is technical leader, HFC Network Architectures, for Cisco Systems, and former senior technology editor for *Communications Technology*. Reach him at rhranac@aol.com.