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STEP-BY-STEP RF TROUBLESHOOTING TECHNIQUES

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A logical approach for tracking down common wireless problems.
By Ike Zimbel

For many in pro audio, working with wireless systems is still thought to be a "nightmare" filled with peril, an accident waiting to happen, and so on. In actual fact, however, wireless systems are meant to work and in fact do work every day in thousands of concerts, theatrical productions, festivals, churches, broadcasts and the like, all around the world.

With that in mind, I've compiled this list of troubleshooting sets to take when encountering wireless problems in the field. Hopefully it will alleviate the apprehension many experience while also solving the problem.

Step 1. Develop a positive attitude. As noted, RF gear is supposed to work. Understanding and believing that — instead of believing that it's nothing but trouble — is critical to resolving issues when they arise.

Step 2. The first question to ask when encountering RF problems at an event: Is this system coordinated? It's especially true if there are problems with multiple systems at the same time. I've been doing frequency coordination since the early 1990s, and in all that time I've had barely enough problems to come up with material for this article. Frequency coordination is no longer an option — it's an essential.

Ideally, frequency coordination should be done before the equipment rolls in but in the event that it hasn't been done, here are some things to do to improve things:

- Someone must take charge and get all RF users on the same page.
- Compile a list of all wireless equipment and frequency ranges in use.
- Doing rudimentary band planning and doling out a chunk of spectrum to each user can help.

For example, the two backline techs on a gig both have Sennheiser "B" (626 to 668 MHz) band systems. A quick scan with one of the receivers shows DTV channels 40, 41 and 44 are present, which takes up 626 to 638 MHz and 650 to 656 MHz. Solution: tech number 1 gets 639 to 650 MHz and tech number 2 gets 657 to 668 MHz. It's not frequency coordination, but it does help eliminate the "every man for himself" mentality and brings some order to a chaotic situation.

Another approach, in the absence of a real coordination, is sequential scanning. It works as follows:

- Turn on "money channel" systems and scan for the best frequency available.
- Place these transmitters on stands (don't leave them in a pile on a road case) and leave them on.
- Then scan the next most important systems, place them where they'll be used and leave them on, and then repeat with each successive system until all are turned on. Again, this is a long way from a proper coordination, but it's better than nothing.

One last point, if there is frequency coordination, make sure that everyone is on the same coordination. I've noticed that now that coordination is becoming more common, a lot of rental houses are sending a coordinator out with RF rentals.

This is great if they're providing the whole equipment package, but if, say, the mics and IEMs are from one company, the backline from another, and the RF intercom from a third, and each company provides a coordination report with its rental, there's a very good chance that all three coordinations will be null-and-void.

Step 3. A key question to ask yourself about a potential problem: Is this real or a red herring? For example, a vocal channel that has been rock-solid all day is suddenly taking hits a half hour before show time. The natural tendency is to look for another frequency, but before doing that, an important thing to determine is "where is the transmitter right now?"

If it's out on stage, on it's stand, there may be a real issue. However, if it's not in the stage area because it's been taken down the hall to the artist's dressing room, what you're probably seeing is the receiver trying really hard to keep receiving its transmitter.

Modern RF gear is designed to be very selective about what signals will actually cause it to "open up" and pass an audio signal to its output, so it pays to remember that the *one thing* that will do that without fail is the transmitter that has been programmed to the same frequency.

Also keep in mind is that if you do change the frequency, the problem will appear to be fixed, but really all you're doing is setting the receiver to a frequency that it doesn't see its own carrier on. Then, when the transmitter is brought back to the stage to sync to the new frequency, the problem is "solved" because the transmitter is back within range of the receiver.

Step 4. If a problem crops up after all has been fine for some time, ask "what's changed?" At a recent festival gig, for example, I arrived on site and was told by the monitor engineer that he was taking hits on one of the eight vocal mics… on day nine of a 12-day gig.

Looking into the problem, I could see that the receiver was taking hits with the transmitter turned off. I checked that frequency on two spectrum analyzers but couldn't see anything that would be causing interference, and also evaluated several other things, including a tour around the site to see if any unauthorized news crews were roaming around.

Finding nothing obviously wrong, I turned my attention to the antennas, a pair of the new Shure UA874XA paddles with the gain/attenuation switch. As soon as I walked up to the first one I could see that the RF overload LED was on continuously, and a glance at the "B" antenna showed the same light flashing.

These had been set to 0 dB on set-up day, in consultation with the monitor engineer; however, it turned out that he'd switched in 6 dB of gain on both antennas the night before in an attempt to better pick up the host, who'd been running all over the site with his transmitter.

Reverting to 0 dB of gain immediately corrected the overload issue, while the hits were in fact intermod products being generated by the overdriven amplifiers in the antennas. (Think of this situation as an "RF fuzz box" — the overdrive creates additional harmonics.)

Step 5. Listen! Spectrum analyzers are a useful tool, but I find a lot of time wasted in staring at them when our ears can tell us the real problem. Examples:

- On two occasions I've had walkie talkie signals get into open receiver channels. In both cases I was finally able to track down the source by listening to the affected receivers, noting a bit of what was said and then asking around "Who just said...?" In one case it was the walkie talkie-based intercom system that the TV crew was using (resolved by moving the Tx antenna off the arena floor into one of the voms), and in the other, the source was the 20-watt repeater from the arena emergency response system. In the latter instance, the signal was only getting into one channel that had its transmitter turned off during sound check, something that wouldn't be the case during the show.

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- I once received a panic call during a changeover, with the issue being that one of the vocal mic channels sounded "gated." A quick listen at the headphone jack on the front of the receiver told me that the problem was not in the RF domain (i.e., not a frequency problem). Note that this didn't rule out an actual electronic fault in the output of the receiver (it ultimately turned out to be a stage box issue), but it did prove that changing the frequency would have been a waste of valuable troubleshooting time.

Step 6. Turn off transmitters. If you think a receiver is truly getting interference, the one sure way to tell is to turn off its associated transmitter. If the receiver goes dark (i.e., no RF level indication) and quiet with the Tx off, it's probably not straight up RF interference.

That said, the problem could still be other issues mentioned above, such as overloading the front end of either the antennas (if they're active) or the receiver. Similarly, if you turn off the IEM transmitters and the mic receivers clean up, the problem could be something along with lines of the Tx antenna being too close to one or both of the receiver antennas.

Step 7. Keep in mind that RF gear is gear, just like mixing consoles, power amplifiers, loudspeakers, etc. — and sometimes gear breaks down. In the past three weeks alone, I've had two different RF intercom systems that were sending intermittent crackling down the comm line. RF interference, right? No, it was loose wiring inside the base stations.

Finally, when someone complains of intermittent noise on IEMs, especially at a rehearsal or sound check, the first thing to ask them before going into full troubleshooting mode is: Where's your cell phone? It's amazing how often they just happened to be getting a flurry of text messages when the "interference" cropped up.

IF YOU THINK A RECEIVER IS TRULY GETTING INTERFERENCE, THE ONE SURE WAY TO TELL IS TO TURN OFF ITS ASSOCIATED TRANSMITTER.

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About Radio Active Designs:

Radio Active Designs, formed by a group of top wireless audio specialists, designs and manufactures spectrally efficient (wireless intercom systems) to ensure that all live events, performing arts, and broadcast media may continue to flourish with minimal negative impact from the fallout of the FCC (600 MHz) auction and TV channel repack.

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