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FACT CHECK: 7 COMMON WIRELESS SYSTEM MISCONCEPTIONS

Chapter 4 of 6: Wireless Systems Expert Series

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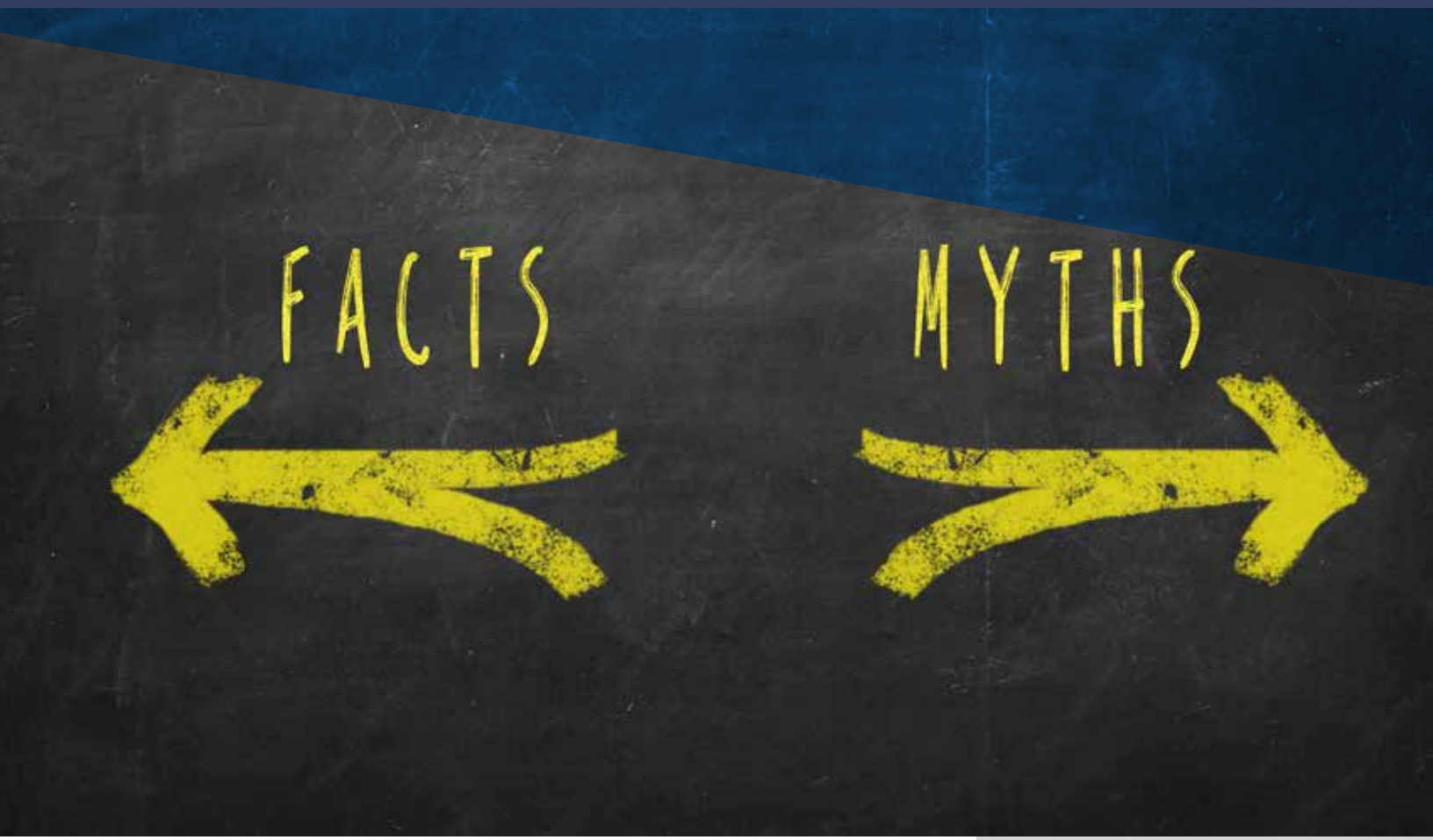


FACT CHECK: 7 COMMON WIRELESS SYSTEM MISCONCEPTIONS

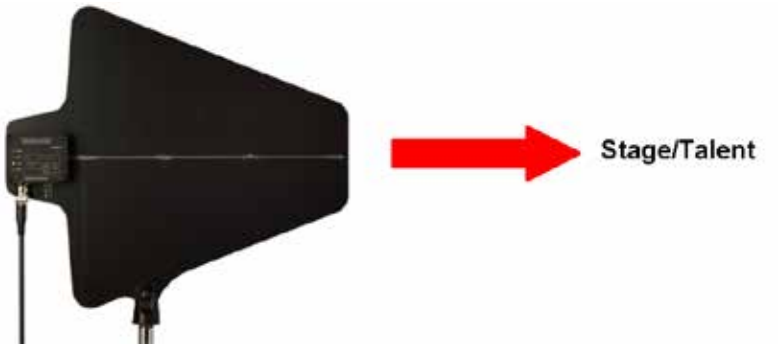
The truth behind often misguided beliefs, and most importantly, a time-tested set of best practices to overcome them. By Karl Winkler

When it comes to wireless systems, it's not uncommon to hear a wide range of opinions, ideas, "facts" and methodologies about anything from microphone technique to drive racks to damping factor. And quite often, these perceptions are either slightly off-base or dead wrong. Having worked in the wireless business for several years now, I've heard my share of doozies. Here are the most common misconceptions.

1. A directional "paddle" antenna is always needed. Sure, a directional antenna can be a good idea – and even a great one – depending on the application. However, it's not mentioned often enough that a directional antenna can be best used when the null (the rear) of the antenna is pointed toward an unwanted RF source, such as TV towers, while the live end (the front) is

pointed toward the talent. (It's the same principle as a cardioid microphone.)

In this way, the RF signal-to-noise ratio is enhanced. Simply pointing the antennas at talent without considering that the boost realized from the directional pattern may be raising the noise floor right along with your desired signal.



2. Using RF booster amplifiers for the receiver antenna system gives greater operating range. The only reason to use RF boosters in an antenna system is to overcome signal losses in the antenna cables. To determine if boosters are even needed, consider that directional antennas have about 4 dB of passive gain. Using a low-loss cable such as Belden 9913F7 means that even for a 100-foot run, there is only about 3 dB of loss at 600 MHz. Thus, a booster is not needed.

The goal should be to have approximately unity gain between antennas and receivers. Too much boost really is a bad thing for more reasons than one. First, receivers are designed to accept no more than a certain signal strength. Too hot of an RF signal can "desensitize" receivers, actually reducing range.

Second, simple (passive) is always best in an antenna system if you can manage it. The more gain stages in the receiver system, the more opportunity for unwanted IM (intermod) signal generation.

3. Certain brands of batteries make an appreciable difference in range or audio performance. Really? It's certainly O.K. to be loyal to whatever brand gives you consistent, reliable results. However, nearly all modern transmitters use DC-DC converters so that they will perform in a consistent manner until the batteries die.

Some batteries *may* last longer than others, but at least for the two major brands (Energizer and Duracell), it's difficult to measure much of a difference in the real world of actual use.

4. Rechargeable batteries don't work in wireless mics. Yes, in the old days, NiCad batteries were a horror show. They would develop memories very quickly while rarely developing the voltages of decent alkaline batteries. But the newer technologies are much better. NiMh AA batteries, for instance, are quite good.

Yes, a battery management process needs to be in place if you plan to use rechargeables. That said, these procedures should always be in place for the overall wireless system setup and maintenance anyway.

5. Going digital solves all challenges. Since when? Yes, it's great to see the innovation with digital wireless that's been going on for the past few years. But what problems does digital really solve? Probably the biggest is sound quality. As good as analog companders have become, they still introduce artifacts into the audio.

We can argue all day long about which systems sound better, but this is largely a matter of personal taste based on what we're used to. That said, digital audio in wireless mics really does make a difference. Without the compander, along with pre- and de-emphasis in the audio path, there is far less distortion in all its forms.

But what digital does not do is change the laws of physics. We still need to carve out some spectrum like we always have. However, there are ways to pack the data streams and use data compression, so we're seeing potentially higher channel counts now with digital than with analog.

Just remember the engineering triangle. In this context, there is long operating range, good audio quality, and high channel count. Pick any two, because you can't have all three in one system.

6. VHF systems have greater operating range than UHF models. Sure, there probably was a time (maybe in the 1990s) when this was true, because UHF systems were just being implemented. But today, practical antenna dimensions restrict the kind of range performance that can be attained with VHF.

Particularly with the transmitter, antenna efficiency matters. And antenna efficiency is based on size relative to the size of the waves being transmitted. This is why VHF antennas are rather large. A 1/4-wave antenna in the UHF band measures 3 to 4 inches – a practical size, and they're quite efficient. Because of this, today's UHF systems generally far outperform VHF systems.

7. There is "voodoo" or "black magic" associated with getting wireless mic systems to work properly. I hear this more often than anything else. Frankly, it comes from those who have not learned the fundamentals, continuing to stab in the dark and/or roll the dice.

But mastering the basics of wireless isn't any more difficult than getting a true understanding of loudspeaker coverage, power requirements, gain staging or any of the other nuts-and-bolts stuff we must learn if we're to consider ourselves professionals. Further, modern software makes much of this quite easy, with the caveat that it's only as good as the user.

Flipping It Around

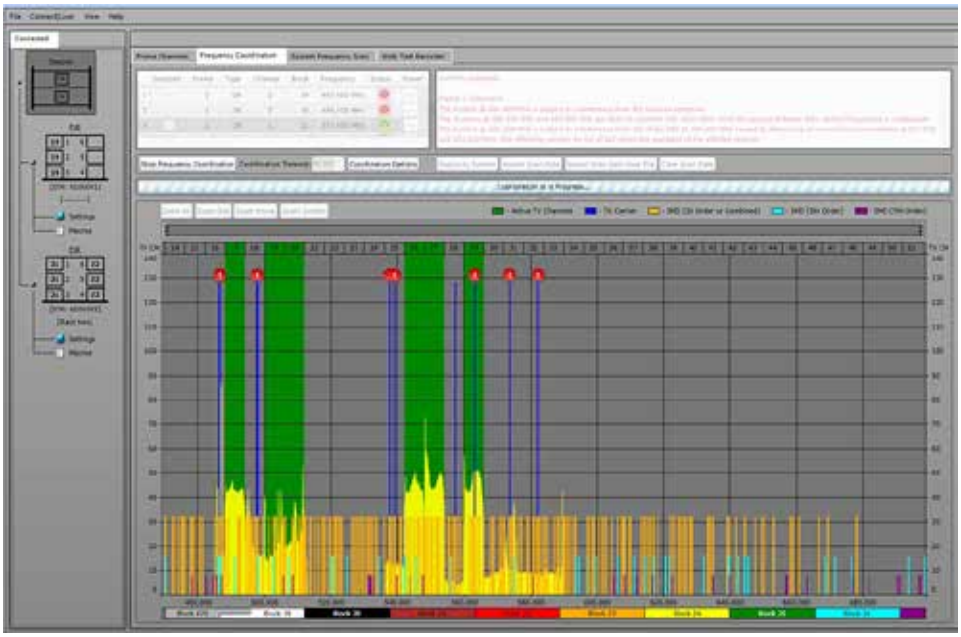
To counterbalance these misconceptions, I've put together a set of best wireless practices. This list was developed over many years, and is the foundation of what I teach when doing training on proper setup and use of wireless systems.

1. Develop and deploy a consistent procedure, based on solid science and experience. This requires learning the fundamentals, understanding equipment inside and out, followed by gaining experience putting things into practice.

There is no one "right" procedure; it can be developed to suit your preferences. However, it should always start with receiver antenna system positioning, then receivers (frequency scanning and coordination), followed by transmitter gain staging. Get these things right, and you're well on your way.

2. Learn, understand and utilize frequency coordination software. As noted, the software is only as good as the user. You'll probably want to customize the settings to suit your style of working, and/or based on your experiences.

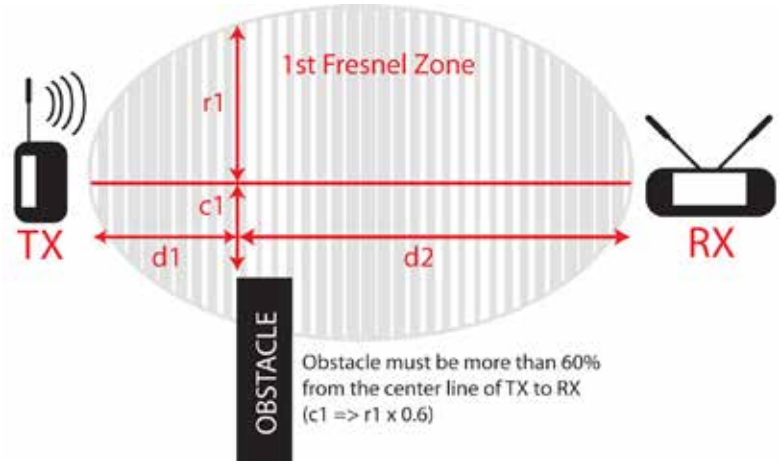
Often, programs have defaults that are fairly conservative, and you'll be able to get more channels coordinated by relaxing some of them. However, much depends on the quality of the system components and the care with which the system has been set up.



3. Understand the RF fundamentals underlying all wireless mic systems, whether they are analog, digital, 472 MHz or 2.4 GHz. Again, no secret here. There are certainly innovations going on in this part of our industry, as there are for loudspeakers, amplifiers and consoles. But just like for those other areas, the fundamentals still apply. There are no magic bullets.

4. Place receiver antennas 10 feet in the air and at least 10 feet apart for a diversity pair. There is actually math behind this (there is math behind everything!) but let's just say that with receiver antennas 10 feet in the air, there's better line of sight between transmitters and receivers while minimizing the effects of the floor and other obstacles in the Fresnel Zone.

As for the diversity pair, the bare minimum spacing is often said to be 1 wavelength, which works out to about 1 to 2 feet for UHF systems. However, it's been demonstrated that the maximum advantage of diversity antenna pairs can be achieved with much greater spacing. A good rule of thumb is to place antennas on either side of the monitor console (or at that approximate width or greater).



5. Locate receivers and antennas as close to transmitters as possible. This is like microphone technique: it's all about signal to noise. The noise floor is relatively constant, although there can be localized noise sources, too. By placing antennas close to the desired source (transmitters), you're increasing the desired signal over the undesired. Just watch out for antenna cable loss.

6. Understand that all manufacturers of quality systems have their own ways of doing things, and none is inherently "better" than any other. They all work well. Learn to understand the quirks of each without disparaging any others. If you're paying $600 to $700 (or more) per channel of wireless, nothing "sucks."

However, operator skills can make or break a system's performance based on

setup, frequency coordination and other related factors. A pro can get a $500 wireless system to work far better than a hack with a $5,000 wireless rig.

True, the more expensive systems do have advantages such as better filtering, often better sound quality, more frequency choices, and probably better durability and reliability. But it still takes users knowing what they're doing to get the most out of these advantages.

7. Overcome the trepidation associated with using this equipment. Follow the steps outlined here and you'll be far more confident in specifying, setting up and using wireless systems. The goal is for all of us to be so good at working with wireless that it's not automatically the first thing blamed when there is noise or other problems in a sound system. That's a worthwhile pursuit, isn't it?

Karl Winkler serves as vice president of sales/service at Lectrosonics and has worked in professional audio for more than 25 years.

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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