

Welcome to Sound Design Live. The home of the world's best online training and sound system tuning that you can do at your own pace from anywhere in the world. I'm Nathan Lively, and today I'm joined by touring monitor engineer and RF technician for the Eli Young band, Stephen Pavlik. Stephen, welcome to Sound Design Live.

Thank you. Pleasure to be here.

So, Stephen, how did you get your first job in audio like your first paying gig?

I was very interested in audio through high school. Just playing in bands and kind of had the whole home studio thing. But I guess around junior year when I first got a car, I interviewed all around town and I got one callback to a pretzel shop in the mall, which didn't take me.

And so I decided, screw it. In the closest venue in town was this coffee shop that just had, like at the time was hardcore bands. So it kind of forced my own internship out of there and then their guy kind of left. So there was I started things like 20 bucks a show and it was three vocal mikes and a kick mike and literally climbed from the board while I was a holding because the pretzel store didn't give me 16.

I have a similar story just to take a quick tangent, that when I first moved to Portugal, I wanted so badly to stay there that after I was there for about six months and I was still wasn't able to find a job, I was basically going to take any job and I was applying for jobs at bars. And this is after I'd been to all the recording studios and all the lifestyle venues.

And luckily, none of those bars would take me either because I didn't have any serving experience.

So eventually I got a job at a concert venue. So sometimes it's, you know, the rejections that really help us move forward. You push you just coffee shop stayed open late.

Ah, they had hardcore shows during the day. It was a late thing. So they had, they had I guess these two friends that came in. One was kind of he had a bunch of P.E. gear, the other was kind of good at booking and they did a couple shows just like outside and it brought a ton of money. So the college I was like, hey, this is an avenue for, you know, something we could do.

So they bought the little strip of of real estate. There was a strip center next to them and opened up a tiny venue. That guy shows up late at night.

And yeah, I'm just imagining, like sitting in a Starbucks and then a hardcore band starts now.

But then there was a coffee shop down the street that tried to copy that model. They did have a stage in the middle of it, but they were a little more tame with with their music choice.

Okay, cool. So. So what happened? You came in there and did you know anyone? Who did you talk to and how did you forcers.

Well, a way into an internship.

I talked to the manager there and asked, they have a thing like that. And he said no. And I was like, well, how about I just work for free?

They're like, I wanted to talk to the sound guy there who he was really a sound guy. He just had gear and an interesting way of running a hit. He was an equipment owner. And then eventually.

Yeah, I mean, he knew he'd have to make it work, but it was like the Mayne's Ron Orks, one of the monitors like Ox too. And it's like, why don't you use the means for the main you know, it was that kind of thing.

The classic little funky. Yeah.

So how long did you do this? About two years until I started working legitimately.

I moved over to Meridian, which was at the time the Live Nation venue in Houston before House of Blues came in. And, you know, they're tied in with all that. So they they took over that area. Cool.

So I'm sure a lot of things have happened since then.

I'm wondering. Was there kind of a turning point at some point where you said, okay, this is not just a hobby anymore or this is not just about making 20 bucks on a weekend occasionally anymore? Like, when was there a moment when you're like, okay, now this is a real career or. Okay. Now this is I know this is what I want to do for the next, you know, significant portion of my life, honestly.

Junior year in high schools, I knew I want to do it. I my girlfriend the time bought me the Yamaha Sonray for some handbook. Whoa. What about your girlfriend Bible at the time?

Right. And yeah. And it's just I mean, and again, just fascinated by it. So I definitely that's what I want to do. And, you know, I knew I couldn't stay in the coffee shop thing too long. There's just you can only go so far with three vocal mikes and a kick Mike and some Peevey speakers. So I actually a weird thing happened.

My mom was a software rep and she was talking to a guy named Justin Sinclair, who was working at a Best Buy. But he was also in the audio game and he was working at a club called Fitzgeralds. And I think is like my 17th birthday. I went out there and just kind of helped him out, had a Giel twenty four hundred.

And it was to me at the time, it was a huge console and he actually had a whole rack, the drama gear that he brought him because he was pretty obsessed with, like just the nicest guy you could have. So this is, you know, another tiny crappy club with drama Gates and I think CBX 160 years. It's like his fun and it's just, again, just mesmerized by it all. And he eventually was the one that kind of helped me into a Meridien when I actually started making legitimate money and mixing real bands and work with real gear.

And then it was.

Isn't it funny how sometimes those weak ties of, like friends of friends or, you know, family members that end up getting you in somewhere that you never would have thought of to, like, pursue that avenue? Like, let me talk to my friends of my mom. That's going to help. Absolutely. I actually just had lunch on the other day and we still laugh about it and joke about it. Awesome. Yeah. It was my mom that did that.

See, if you could also take kind of a now the 20 thousand foot view from above. Just looking back and everything you've done so far. What's one of the best decisions you made to get more the work that you really love, to not be afraid to leave a good thing in hopes of something better?

Man, that's so hard, right? I know, cause I think I feel like there's definitely two schools of thought, which is the one of them is loyalty, which I'm really bad about what good work has. But ask her. And there's the guys that and there's nothing wrong with this. But then, you know, going to a job and gaining what you can and leaving and climbing the ladder that way.

But if you're the type that sticks around a company long enough or longer, it's definitely incredibly hard decision to leave and hope for something better. But in the Times I've done it, you know, it's very difficult, but it always has worked out well.

Would you mind taking us to one of those moments for you? Like what was one of the hardest decisions you had to make to leave for a potential other opportunity that may or may not work out?

The main one, I guess, is I was working at a you just kind of system tech work, which I really enjoyed because I was really into submarines at the time. And there was a big staff change over where you got to. The point was like, all right, who's staying and whoever stays. I was on the principle staying. And they want to, like, make a position where I kind of have more responsibility and a car and was like, yeah, I'm in it for the long haul.

And, you know, then maybe I got it out, but I was on a tour. So then I got the touring offer. And then so after all the whole I mean, it would have in it to win it. Yeah.

We're going to do this now. I'm 100. I'm starting to make it. Last year olds would change my mind. Exactly. And then about two years or so, two weeks later is like so out.

I never thought this would happen. That's exactly what did they say. He understood is mainly the owner, which we were close. But, you know, he gets it.

It's people come and go and they get there and they do their thing and then they go out on the road. And that's the dream of, I guess a lot of audio guys was mine for longest time.

And and what was that tour that you got offered at that time? Elia, 79, Young. And here you are. So how long have you been working with the Iron Devil? Seven years. And Satel, talk a little bit about the band. What kind of who's onstage, what kind of instruments? What kind of inputs are you dealing with?

I'm up to 48 and monitor world.

We have the stage right guitar stage, love, guitar, keys, bass, tracks, drums, talkbacks, crowds like it is set for peace and for peace. Principal one orks player.

And how many channels of wireless with backup? Some around twenty three.

And then when you guys are touring, are there also support bands and then are you working around there. And then there's other, more channels of wireless on top of that. Are they using yours? No. They'll bring their own. And I generally coordinate them when I can. If not dodge them is kind of weird and there's ways to do it. But it's not really the best for the spectrum. But. Yes, so there is more on top of that.

I generally try and hit at least 50. Also mainly because the part 74 license requires that you do 50 frequently to hold it or legally, I guess, or not defraud the FCC in that sense. Wait, what are you saying? What license? So there's there's actually a really good talking point. It's a really good thing called a part 74 license, which up until recently was only allowed for video production. As far as on scene, you know, on location shooting, but it gives you protection.

Right now, everything is what's called a park fifteen, which is unlicensed. Basically, you're a secondary service, so you can't cause interference. And you have to accept all interference with the part 74 as a licensed user. You still can't necessarily cause interference to a primary, which should be like a TV station for us. But if an unlicensed operator say the opening band is turning on transmitters, doing my show legally, I can shut them down.

It gives them the option, the option to operate at one hundred and 150, 50 milliwatts, whereas if you're unlicensed, you can only go to 50 milliwatts. And also, we're talking about white space devices, which is what we are using, unused TV channels.

You can register within one hour, actually, you think, and register pretty much immediately for protection against newer devices are coming out, which are using that spectrum for rural Internet distribution.

Whereas if you're unlicensed, you have to have about I believe it's 24 or 48 hours or no, it might be maybe up to a week. You have to a year to register foreign advance, get protection from that type of device.

So parts of new for license is a really good thing to have. But you have to prove, not necessarily prove, but you have to be honest and and use a minimum of 50 channels on a regular basis to qualify for the license.

I see a minimum of 50 channels. So you're talking about these protections. Can you tell me about how this has played out for you? And it hasn't come up yet. How it might play out? What is a protection look like? I mean, are you actually going up to someone else and saying, hey, you're causing interference? I found you and now I'm turning you off. Yeah. Luckily, you haven't had to use the license to do that.

Just generally the you know, the respect, I guess, or of it, for lack of better words, the pecking order of a show. So, you know, it's you know, if you're if I'm in such chains, I notice there's a couple of transmitters right where I am in a I really don't have time to re coordinate. That's kind of ridiculous. So I'll go out with a directional antenna and a spectrum analyzer and I'll find them.

And generally, it's just a respect that they'll turn it off. I know that there are some coordinators that do. I mean, I keep my license with me in my in my work box. But I know there are some guys that have pull it out and how to go up and be like, look, we need to, you know, we need to accept some kind of solution. And generally, it's you need to work together. It's not it's not something to abuse.

And it's in two parts need for license. Users have to just kind of mitigate the situation themselves. Because if you get the FCC involved, it's gonna take weeks. And it's kind of not really you know, it's not going to do anything within there. I know I've I haven't personally had to do that, but it does put some teeth in your bite. This isn't just some crazy sound engineer coming to bother me, like, oh, he's got a license to be the other big one.

I guess the whitespace device, we're not seeing a lot of it yet, but Microsoft is very interested in this. And they have a belief, some patents already where they will distribute high speed Internet over unused devices, unused white space channels, where that's gonna be really hard to predict in the future. We're trying to coordinate frequencies. So having that protection, whereas saying that I'm here. So the system, whatever it is, actually has to go through and check this database.

And if it sees that, hey, there's somebody that's reserved this because they're wireless microphone channels here, that Weiser's device has to move to a different channel for whatever data it's sending out, which would be usually Internet. And so we're we're going to see that in the future. We don't necessarily know when. I think some of it is in testing already and some campuses. But so that's another good reason to have to get this license if you're eligible for it.

Because, again, our spectrum is shrinking in more ways than just losing 60 megahertz. Does that mean that you are basically putting in all the dates of your tour saying, I'll be at this address and from this time to this time, I'll be operating on these frequencies and you have to submit that to a database? I have it, yes. I haven't run into it.

I know a lot of coordinators doing large vessels do. It's actually you can put it in. There's a couple different Web sites, but one of them, the big one is called Spectrum Bridge. We enter your I.D., the channels you're using, and it'll take it or it won't.

Wow. And how do I get this license and how much is it going to cost me? The easiest way to do it is through professional wireless systems.

It's about five hundred dollars. The other way you can file by yourself, but there's about a 90 percent failure rate with that. Oh, it's it's a lot of legal documents.

Be a professional wise and has a service where it's pretty much guaranteed as long as you're not like, you know, a felon or.

I guess if if they actually do ask if you've had offenses with the FCC before they check your upgraded. Yeah. If you've operated a pirate radio station, got caught, you're probably not going to go ahead, put a you know, it's just that kind of thing.

Maybe any challenges that you've had in the last year that you had to find solutions for? Yeah.

The interesting thing about working with that band is that they own all the audio equipment in Seattle. Okay.

Yeah. There's a lot of changes that will go through that. We can't just go back to an audio company and say, well, I wanna use this. I want to switch this out. It's kind of just take it apart, build it, make it work, that kind of thing. So going to the wireless rig with them is really fun because there's just been a lot of changes through the years and some of it is band aids, like we switched to a different back line Iraq.

And I have, you know, just it's really not the appropriate way to do this kind of just some passive splits with the wired.

It's where each receiver in this rack had at least one EHL PDA. But then what's a dipoles all over the place, which is kind of make an antenna farm unless it's absolutely not proper and we just switch to different rack. And it doesn't work in this installation. So I did just order on eBay a another different attended to show, which also came with some BNC cables that we're not quack's. And that's a different story. But be very careful of cheap cable thony.

All right.

So you're it's not just like your specking a system and saying this is what the band needs and then it comes out with a rental company. You basically have to take what they have already and make it work with maybe a few minor like cheaper changes, like band aids, like you said. Yeah. Hit pieces together, which luckily helps because I have a lot of supplies on hand just at home and I'm from my company.

I have a lot of cable and all kinds of stuff too, to help build those things out cheaply and to get it to where we really are using a professional system.

But, you know, Spector or built in a very awkward way, just pieced together over time. Wow.

So when you first started with them, was it, like, barely functional and now you're, like, pretty happy with it? Or do you feel like you still are not happy with it and you have a lot of changes you want to make now? It's it's great right now. I mean, it was it was working in the get go, but it was just and there's still some weird things going on. There's some definitely ill practices going on, but it does work.

Yeah.

And actually that's a big one, I think. But for this one, let's say Combiner is and I've seen this before. You cannot take it for an extended amount. You cannot take the output of intendant combiner, put it to the input of another one to get more channels as far as if you want to, like, refer to that as cascading. Mm hmm. That is horrible for right now. What's happening is so we stuff old like a G3, AC3 Combiner is with PSM nine hundreds into which you have to piece of nine hundred goes ten milliwatts, 50 milliwatts, 100 kilowatts, where the maximum input of the AC three is 30 milliwatts.

So we have to go to ten milliwatts. But then because I'm using a passive combiner to get the two four channels into one antenna that I'm losing three db there that I'm losing to, to be in cable. So I mean, do you pump up to 50 milliwatts and deal with the heat?

A little bit of distortion in the game, the path India generally I do.

And you don't see too much from it, but it's not proper practice, so it's just weird things like that.

So you mentioned earlier El P.D.A and Dipole. What are those? Well, the LAPD, the the shark fin, the paddle antenna, which is a wideband directional antenna, you can almost think of it. And we say directionals a cardio weight pattern, but it generally has about seven to nine DBI dgi of gain, which should be passive gain compared to an antenna. That's just an arm. A directional radiator. Mm hmm. Definite important to point out that we talk about Gane and antennas.

It is not active. It's not like an amplifier. It's just say that I'm not radiating in this direction. So that is actually radiating forward. What we'd be reading behind me that's not there is shifted to the forward direction, which is our forward passive gain. So, yeah, I definitely have one of those to shoot across the stage. It was important to make sure that each each side, one side of university receiver had an antenna with gain.

The other side had just a dipole on it in the rack. But because of the rock size and where the antennas are located, it just didn't work as well. Well, we changed rocks out, hence the the the antenna combiner that we had to eventually buy.

Let's talk a little bit more about wireless than Stephen just to get us started. What is maybe one RF myth that you would like to never hear again? Yeah, I guess so. I definitely think this one is the one everyone here is in and says is that it's black magic or it's voodoo and it's just half loaded.

Oh, God, no. Okay, I get it. I get it. Because it's you're saying it's science, right. Like these are things we can predict.

Absolutely. And excel at. And I said this before, but I think the biggest thing about this that everyone's just freaked out about is that we have no way of perceiving this. I mean, the lighting. Do you see it? Audio you can hear if you knew nothing about audio quality, you can't say, oh, I hear this or I hear that. Right. You know, or you can you can see video. We. I have no way of proceeding, R.F..

So we just say throw our hands up and go. Well, I don't know. You know, that's just that's just not good, right? Yes, it's you really you just have to take the time to learn about it, which is fair that some people really don't have that time. And this is a very fast paced industry. But there's really nothing magical or voodoo about, you know, the upside is that maybe that makes your job more valuable since people are so scared of it.

It does.

Right now, you don't want to be working with colleagues who also feel that way, right?

Yeah, there's I mean, ah, of course, Natans do make a decent amount of money just because there is a lot behind it. That really isn't the deal with audio. There's even some guys that come in with communications are F degrees that jump in to order you in. You know, it's it's it's something that's very separate. Whereas, you know, whether you're a mix engineer or system tech, you're all dealing with with an audio where you can become just completely in RF tech and jump and do it and be like, you know, not really be familiar with the concept scene at all, but still do your job very efficiently.

So last month, you participated in an online summit that I produced, it was called Wireless Workshop, and I thought you did a great presentation. It was called Wireless Crash Course for monitor engineers. So one of the most common wireless issues that everyone asks about and wrote in about ahead of time.

And I'm sure one of the most common questions you get is how to avoid dropouts. And that's such a difficult question, because as you say at the beginning of your presentation, there's no one solution.

So if you could just answer people and say, well, the way you avoid dropouts is by, you know, painting everything red, and then that would be great. But then I guess, you know, people wouldn't be asking that question anymore if it was such a simple solution.

So you say in your presentation, there is no one solution. There is no magic box. We need to maximize efficiency improperly, deploy every device and step in the chain. Only then can we blame the video guys. So if that's the case, could you help me get started, I guess, by giving me kind of a prioritized checklist of things to look at that can help me track down these wireless dropouts?

I'm wondering if maybe we can go through the signal chain and we could even use your signal chain on the Eli Young band if you want, or look at, you know, like a common signal chain and maybe just with each step, look at what are some common fit pitfalls that could lead to wireless dropouts.

I think we should approach this, start with hardware, and then we need to get into coordination because that is it.

I think it's 50 percent hardware, a 50 percent coordination, maybe not necessary that no specific number, but they're both equally important. Yeah. So let's start with the transmitter level.

Let's say I am. So you're coming out. You need to make sure all your cables are correct. I want to say that I mean, start off with just saying that using the right amount, the right type of cable, there's quite a few times that you'll see video cable involves 75 ohm, which is a huge debate. You can open up with an RF text. Some say absolutely never use it. You will experience some loss due to a mismatch.

So it you can but it's it's not the best. But.

So let's start off these in the right amount of cable is the right type of cable. Okay. And then going back to that reference that I mentioned earlier about that good.

That combiner that I just bought it tested this cable and it's it's showing ninety three ohms in 3-D view of loss at twelve inches, which is absolutely just unacceptable. So open it up. And it's actually two conductor 18 gauge wire that was terminated. B and. So it's not our cable at all. It is somebody somebody bought a bunch of BNC cable Borke and thought, OK, this is this is, you know, workable. And it is you get your money.

The problem is a lot of these sort cables.

Now, I really I just wanted to show you a 44 and it was a really good deal just for that. So I just e-mailed him and told him to, you know, be careful if you're selling these, you know, this these cables to watch people. This is not right. Well, it's not because. Well, I bought it from a seller. Yeah. And so he didn't know either. You know, it's going back to you kind of to test collects more than just continuity.

But so it just makes sure you have the right cable. And the the easiest way to do that is a lot of times it will be marked in the side, I should say, in R.G. number or whatever the manufacturer is. So make sure you have the right cable. Make sure. I don't think to look at is make sure the actual center pin is not extruding past the connector itself. That can be happy. That can happen due to a bad termination or if the cable slips.

But that can eventually damage A and C port on whatever piece of equipment are using. So, yeah, it kind of starts with making sure.

Right. Cable for the job in the right cable is basically whatever the manufacturer recommends.

Right. For my transmitter or my receiver. And it pretty much R.G. eight extra RGA eight, you'll be fine. OK. We start scraping off of those numbers, which there's just a plethora of different cables, but that's kind of the most common you're going to see. And that's referring to an old standard called radio grade. It's still kind of used, but everybody manufacture has, you know, their specific cable type, their

number. But it's usually you can kind of say that it's an eight X or an eight, which is the stuff that eight X will be like this, the thinner cable it sure sends out.

RG eight is the thick stuff. You think I wouldn't think of low loss. So from there, we need to make sure that you're actually wired correctly, let's say from the AMM perspective, going into the combiner again. So an antenna combiner, if you have to, if you have more than four channels and you have two for Channel Combiner, it's anyone who is one antenna, you cannot take the output of a combiner plug into another one. And the main reason is, again, though, going into talking about how let's say for this example, we get this, I've seen a lot on flight.

It was well, with the AC three Sennheiser combiner is actually saw one. There was three of them Daisy Chain together. But we have to think about is that's 430 milliwatt inputs.

So you're dealing with this 120 million hits now necessarily. Not all of them will combine at once victoriously to cause 120 miles, but it will happen. And you're putting that to a 30 mil on input. And that's a substantial overload. That's the reason we don't want to do that.

And I've seen that so many times. If you want to combine two active combiner is you have to use a passive combiner like a Wilkenson power divider that can take that. So that's a big one. So do not cascade Internet active and telecom abiders. From there, you got your antenna, they used to make sure your antenna is in a good location, line of sight is very, very much key. R.F. does propagate through walls and then reflects all over the place.

But your direct line of sight is your best, your best bet. Make sure antenna is not close to metal and much soon not close to power. And that's kind of on the transmit side. And now, Combiner, as you go bad as well. And that's kind of where it's really, really handy to have a spectrum analyzer.

We just out with Andy Grammer in on a flight out with them and they're having issues. They had a PSM, a thousand system, and we're using nine hundreds. And it was a four channel combiner in the actual combiner was just putting out a lower output than it should have. And it was causing drop outs. Wow.

So just a slightly lower output. And it was that was low enough to make it drop out. OK. Oh, absolutely, yeah. I mean, really, all we're doing is trying to maximize signal through the wireless link to the receiver. I think actually, let me just go back to that. A drop out. I'll drop out is as you have a low enough signal that the squelch engages.

So if you're dropping out, you've lost signal for for some reason, whether it's through your transmission system or maybe you're seeing some sort of interference, that is that the receiver is actually kind of jumping. Maybe etem capture effect, trying to jump to a different channel or that interference, similar suppressive enough to engage the squelch that drop out, as is that you've lost enough signal with the squelching gauges. So anything that decreases the signal can cause the drop in.

Going back to a binder's. I've seen a lot of that. Sure. The P.A. A ones are 420 ones. They might lose actually just one output or one input. I've seen this one in on the combine go bad. It's only one frequency's bad. The rest think about our work switch is actually pretty tricky to locate. But that does happen. And sometimes entire commanders fail. And that's kind of tricky to see without a spectrum analyzer. You can eventually track it down.

And just by walking out packs and figuring out that, hey, these four packs, no matter what frequency I use, are not working. But it's also easier just to see maybe this for Shalika. Bionic is for channel combiner on a spectrum analyzer. Say these four channels are significantly lower across the board. And, you know, so anything can fail. It's definitely don't don't rule anything out. And transmitters fail sometimes. They just won't output that frequency.

You see it more in microphones, the body packs, but the RockMelt ones will do that as well. So as far

as the hardware side, I think for IBM at least, that's kind of it. Now we talk about a transmitter from microphone. Really not much. You can happen there. It works or it doesn't. Now for a body pack and a I see a lot. Let's say you have a shirt or lecture Sonic's where you have an estimate connector for the antenna.

They have a little locking a locking nut on them and sometimes that rolls back a little bit. And so you don't have a good connection to the antenna. And I've seen drops haven't because of this. Oh, wow. Yeah. And so if you're looking at your diversity receiver, if you see both A and B signals go down the same time, then you have a problem with the actual signal getting to the receiver. Not one center or the other.

If not, you'd see one side drop, the other stay constant. And so I've seen this lot on on guitar packages where the washer that nut backs up a little bit. And so the antenna doesn't get a firm connection in there on the transmitter itself.

Just lose signal. Yes. On the body pictures is better. So you have to go there, take the antenna off, tighten that nut down, then tighten the attention back on and it's totally fine. Wow. OK. So we've talked about several different points in the signal chain here.

But my biggest takeaway so far is that what a dropout is is low enough signal that it goes below some threshold where the squelches engages wherever you have your squelch set. Right.

And yes, that signal attenuation can be caused by a lot of different things. And basically, every point in the signal chain has some effect on the signal level. And so we have to take care to make sure that we're maintaining the signal level within whatever the operational parameters are. Right.

Because if it goes too low, it engages squalls. If it goes too high, we have overloads.

Absolutely. OK. Yeah, it's yeah, it's really just maximizing gain to the transmitter from her from the transmitter to the receiver. And I know we talked recently the wireless workshop, but the most loss you're gonna see is not wireless path. It is important to know how much cable loss you have because that's, again, we're trying to maximize signal.

So if you're running, you know, 200 feet of cable, that's with luck, you know, for trying to get a signal out from maybe a transmitter, you're going to lose maybe five, six, seven DBI. But if you go 30 feet, you're going to lose maybe 30 DB wirelessly. So it's you really just need to pay attention to all your gains and losses.

Steven, I want to show you I'm sure you have done this, but I wanted to share an aha moment that I had at a shared training workshop earlier this year. So they had some kind of spectrum analyzer there and they were just basically showing us the level coming in from a transmitter.

And all they did was take the transmitter pack and move it from the front of their body to behind their bodies so that their body was in between the transmitter and the receiver.

And you see this huge decrease in signal level. And it was like terrifying. And it was such a good moment for me because I had heard that, you know, you should make sure that you have line of sight. And I've always heard about that. But I was like, I can't be that much right. Like, the microphone still works. But now it's so clear to me that I need to as much as possible, try to make sure that I place transmitters if I'm placing them on a human, if I place them so that they will be without obstruction as much as possible to the antenna.

So if the antenna is behind the stage, it's good to put it on, you know, the back of someone, the transmitter. And if the antennas are somewhere in front of the stage or in front of house, then I would try and put the transmitter, you know, on the front or the side of a person. So just to not have that human body obstructing it because these bags of water are one of the biggest problems, right?

Oh, absolutely.

Yeah. Body absorption is huge. It's one of the things that it's hard to measure. But I know a buddy of mine did some tests and he I think he found up, too, with the intendant touching the skin or at least grabbing like around the bonobo micro, the antenna being get up to 90 to be of attenuation. Yes, the line of sight is huge. And also with that, I would just try to make sure the antenna, either if it's a weapon, sent it from a body pack or if someone's grabbed the microphone that the antenna doesn't touch skin because that will also take out another 20 B.B..

And I love that you shared this tip or someone else did at the Wells workshop, maybe multiple people dead, but putting a plastic straw on the antenna sounded like a really smart, easy way to get the antenna and make sure the antenna is not going to touch skin. Yeah, I have heard that. And also, it'll keep it straight because a lot of a lot of the antennas do sag a little bit or over time there is kind of get bent.

So under Usher there, this is another thing I never understood until wireless workshop. I was I was so surprised. Someone asked because they were you and some other people were talking about the orientation because these antennas and the transmitter and receiving tennis have a polar pattern and they need to be aligned for proper reception. And so, yeah, if the antenna gets built bent at all, which happens a lot, you know, when we're putting transmitters on humans and they're getting moved around and there's clothes and stuff, then that's going to change the way it the way it transmits.

Right. And I don't know how much loss would be experienced. I don't know. Do you want to say anything else about what happens when you bend an antenna so bending and or just having it near 90 degrees off of let's say that you're you have a baby holding your microphone vertically and the antenna is vertically a polarizer oriented, and that's great that you should have maximum signal transfer. But if you go 90 degrees off of that, so I'm holding my microphone horizontally in the antenna is a is a vertical.

This is where it gets tricky. Guess theoretically you would have an infinite amount of loss, which if you're an anecdote chamber for RF, that may be true. But because we have so many reflections in our environment and each time RF reflects off of something, it kind of bends the wave a little bit. It is polarization that we don't necessarily see that infinite amount of loss. But you do see generally maybe 10, 10, TV, ten, twelve.

And that's a very rough number. That could be anything. But you do definitely see that loss. Not enough to just completely make it disappear. But it does affect very much so, which is why, again, there's a lot of interest in circular, polarized antennas, which right now is the Heela call antenna, the Heligoland 10. OK. This is one thing I didn't know about also until recently as this fun because it was so much of this is brand new for me.

OK. I think the most common helical antenna that people will recognize that they've either seen on shows or seen photos of is because it's funny looking. It's Plass. It looks like clear plastic and has like a circular tube on the front. So it's like a big round desk with a tube on the front, right? Yep. The old corkscrew looking thing. And that. Is ultra directional, right? So that's even more directional and focus than an EI PDA.

Absolutely. Which is a blessing and a curse. They do make different kinds.

So the one that I was familiar with, the professional wireless, the eighty eighty nine has a 60 degree beam with kind of imagine that if you're looking at the beam, it's 60 degrees wide, which means it has a very high directional gain because if we have 60 degrees there, then all the gain they'll be radio behind it is focused forward.

Which kind of gives them about 12 to 14. IDBI is what they spek. Now they have some they just look like domes in a Sennheiser has kind of the big one. The A 5000 something. I know that one I believe is 80 degree beam with and it is just as much.

Yeah. That one's 80 degrees.

I think professional wireless and has a dome. It's 80 degrees as well. So you have a little bit less forward gain, but you do have a little bit wider spread, which is really nice.

And you still have that circular polarization. The RF venue, the the collapsing ones, I think are around 70 degrees. But don't quote me on that. Some don't exactly remember here, but a bit.

So the problem with that is that they get incredibly directional now. But you have to remember that it's they also follow inverse square law. So as you're radiating it forward, you're radiating out. So that doesn't mean it's locked into just 60 degrees. It's definitely radiating all around. When it comes out. But you do have your main power within that 60 degrees.

I see. So if a standard like. Sure, shark fin el P.D.A has no coverage, angle is something like 120 degrees. That's still wide enough that I can kind of just put it up and point it in the direction of the stage point in direction of the talent where I think the transmitters are going to be.

But when you get to, you know, half as wide at 60 degrees, that now requires a little bit more focus.

And you can't be so haphazard. You really have to have it pointed in the right direction. Absolutely. And in some weird situations where the stage is very awkwardly shaped and I'm sure throughout Billy Bob's in a fort where it's going on at the stage of Billy Bob's, there's a very tall section that has the mainstays and lighting, and then it kind of comes down to a roof that's about maybe seven foot tall or there's still performance space, neither side. And so when you have a bass player underneath this roof with pipes and all kinds of metal that Tara doesn't like, literally moving that he local a couple inches actually got coverage over here.

It's, you know, scary, a tighter, tighter being, which means there's a little more planning on where you're pointing it.

Anything else on your mind that you would want to share with people in terms of troubleshooting their own dropout problems or having actually Rookwood going in to receivers?

The diversity receiver looking at the front of it is a really good way of, again, troubleshooting. If you see both meters drop, there's a problem signal coming into it. If you see one side dropping consistently, there might be a problem with that cable, that antenna. It could be a multi path. But if it's if it's existant drop, you definitely look at that side. But again, if you see it, we see both sides job the same time.

There's probably probably a transmitter going to receiver. It's hard to tell that I am. Now, there's also the interference with coordination, which if you're not coordinating with software like where I was workbench or was his management or I guess you do need to keep everything in the same group.

If not, you again, intermarket is huge for us, which can cause drops because that enemy is going to get them within the channel filtering of the receiver.

Whereas let's say that if you had frequencies spaced, maybe 300, kill it forward. So if I'm going to kill her, it's a way the channel filter and take that out. But if it creates inter mod that can get inside the filter and that can cause problems. So if you're doing it, if you're coordinating only on the equipment you're using.

You need to try and find a group that has the most open channels and get everything within a channel that's in that group because the manufacturers pre coordinate these. If you're doing it with software, you need to be very careful about what you're letting the software decide for you. I have met this before, but be very careful. The exclusion threshold, a workbench, because if it's set too high, you'll definitely put your channel to close to her on top of things that it doesn't need to be on, like TV

channels in all of these things in college dropouts as well.

So the signal competing for, you know, with an interference can cause that to drop below Scott's level and then it causes drop.

One more thing I'm going to say about troubleshooting, because someone posted about this on Facebook recently. What I suggested to them was to start by just drying out their entire signal path so that they're not, you know, just trying to do everything from their own imagination. It's it's hard to keep all these details in your mind at once.

So draw it out like in a diagram or a list, however you want to do it your entire signal path. And then for each point in the. Well, chain there try to list as many problems as you think to go wrong there or things you could test and then you can kind of go through it one by one.

Otherwise, I think troubleshooting a complex system like that just on your own, like, let's try turning it on.

Turning it off again. Turn it on again. Let's see if that works. Then then you you know, then you do five tasks and then you forgot what the first one was. And yeah, be hard to do without a plant baozi from, you know, maybe. You know, having to repeat the same tests over games. You know, we got something.

Tell us about the biggest or maybe most painful mistake you've made on the job and how you recovered.

This one has to deal with power and sparks.

Wow.

So, yeah, we're we're doing a festival in Steamboat Springs, Colorado, which gets incredibly cold and I think is about negative 10 this day. And one of the generators sees that because the diesel froze like a diesel conditioner you put in.

It's just, yeah, it's cold.

We had a switch to an emergency generator, our back of a say. So we powered down audio distro. I thought lighting was powered down anyway.

So if I don't remember why, but for some reason, the only tales I had to switch over to this generator had a European color code and which I didn't know they got. Well, I knew the colors were wrong, but it know that it was supposed to be. So I kind of just in my head thought, well, maybe I'll just match his colors as closely as I can do America. So you're a generator just happened to be there.

And so you have these cam lock connectors in your hand and that you're that's you're trying to connect them to. Oh, no. It was it was an American generator, but it's it was a European color code has browns and oranges. It's not the it's not the the black, red, blue, green, white, four tails. And so I was just trying to say with this color looks like that color.

So we're gonna make this neutral and this car looks like that color. We're gonna make this ground. And they will meter it at the distro because it's it's like blizzard conditions, bad visibility in a parka, trying to tie a generator. Oh, I get it. You're outside trying to handle this because the generators outside.

Okay, this makes sense yet. So I'm just trying to kind of make the colors work in my head. I guess a neutral and a hot got crossed because I flip the switch and then you just hear screams from inside the car.

And as it turned over Greek, it so what happened was within that, I guess, the hot hitting, the neutral it only blew it blew all the pastors on the bunch of Mach one. No one's on the upstage.

Wait a Mach one and one's a lighting instrument.

That's a little mover moving head wash came in. They thought we blew up. Well, look it. They thought I blew up all the lights. And, you know, word spread real quick around the sound that the tent was on fire and all this good stuff. It turns out it was just the actual. No, they just they all popped instantly, silly and sparks when everywhere. But it was just the pass through is the actual power con out that broke.

So everything was fine. Everything that's fine. No big deal. Why is everyone freaking out?

There's stuff about throwing a big old power switch in here is screeching and popping and you know. Oh man. That's terrible. I get. So, I mean, you didn't you didn't really learn anything because you're just like, well, the colors. I hope that never happens again. Well, I learned not to just be so lax with, you know, trying to quickly troubleshoot a power system, make sure everything was powered down, right?

Yeah.

Yeah, that was true, too. Audio is powered down. Oh, wow. That's amazing. Steven, will you talk a little bit about what's in your work bag? I'm sure you have a lot of good stuff in there, but are there a few pieces you could share with us that you think are most important or maybe you think are unique that other people might not know about?

The pelican has. My main spectrum analyzer, a bag full of connectors, all kind of adapters you could ever imagine. I definitely carry two Wilkenson power dividers.

Which is you can think of it as a splitter, but it can actually take power as opposed to, let's say, a resistor split like the way to twenty one. You don't really want to put the power into that. So there's just universal RF splits which can be used in any situation, transmit or receive. So I carry two of those and use them frequently on flight. Hate's a carry two for pole cavity filters.

What is that?

So a lot of the filters you see on the market have a stop, a fixed start and stop, or a fixed pass band, which let's say might be four and seven megahertz to 570. A cavity filter is just kind of what it sounds like. It's an empty cavity with a pole, a screw in it, a pole in it. And depending on how far the screw is, is what frequency is resonant, too.

And so you can't get a nice deep filter that you can retune and on sides an adjustable filter for you to come in.

It's a tool, the filter. Now, generally, these filters lot a tighter bandwidth. They're going to be you kind of order them to get a TV channel. Most of mine that I have in my little office slash shop are six megahertz. This one is the smallest one I have. So it fits in my bag really well. But it's eight megahertz, which is fine. And so I do carry a tunable filter with me. I've only had a bust about a couple times because it just really bad environments.

But you can get a really steep, nice pass band. You can do it anywhere. But to do that, you need a some sort of two port analyzer.

So I carry a cheap network analyzer. That's handheld. Battery powered is actually made for hams called a KC nine and one s hams and amateur radio operators. But it really is a cool device because it can do antenna measurements. It's single point measurement, which would be an S eleven was a reflection. Measurement is vector. So you can see phase the two point of scalar, which means you're only looking at amplitude over frequency. But that's really all you need to do to tune in, to fill tor check,

to do a different tell it different type of testimony.

Kofax. But it's a really cool device. It also is RF signal generator has the insertion loss meter. It has kind of an RF multimeter type tool thing. Wait, so the difference between spectrum analyzer and network analyzers at spectrum. Measuring RF in the air in network analyzers.

Measuring pieces of hardware like cables. Kind of. So.

So a spectrum analyzer is only going to take an input and break it down over frequency and amplitude. So a network analyzer is just what it sounds like. It's measuring a network. It's measuring multiple things. So you can make and you can make an American lizer out of a spectrum analyzer if he has something called a tracking generator, which is what this two point measurement does. And you can think of that a tracking generator is almost like the pink noise tier artier.

You're smart and the spectrum analyzer is your arterials smart. So what it does is, let's say the two point from this network analyzer is it sends a just sends RF noise across the entire spectrum. And there's an analyzer that tracks it and it can lay down a trace to show you the response of this instrument or whatever you're measuring, which would be network analysis. It's two parts. So especially in light is essentially a part of that. But it's built into this one unit.

And what is the spectrum analyzer that you carry with you? I carry the t'ai PSA 2072 and as my back of a carrier, the signal hound s.A 44 B, which is a PCR based analyzer. I definitely carry as many antennas I can fit in there. I always carry two 10 has a 10 31, use a K a professional while systems el PDA in2 lecture Sonic's SD six hundreds just for whatever you might need to add up. Why use the ten thirty one for a scan and then again on flight eights.

I'm always rewiring our for eggs because it is just amazing how many weird things people do to RF rigs that it's just a lot of his flight. It's I would not get by on without this Workbox I carry with me. No matter how much you advance and spec it out, people just do weird things with our F rigs. Right.

Because as we just described, most people still think it's black magic or I should I should stop supporting the myth. A lot of people still think it's black magic. And one of the results of that is that people do weird things with their rig. So you have to travel with five different antennas. Yeah, I'm you know, it's funny because there's times like, man, we're traveling with 250 cases this time. I just leave us behind. But I carry it anyway.

And that's, of course, the time they rewired.

And I actually do carry with me a battery powered antenna distro that's usually used for. Motion on sight. Ian G. Type things, but actually you have to have have had to wind up using that for the first time really in Korea when they just cascaded like fifteen UHF receivers. And it just real quick, you. While they do have Cascade ports on them, each time you cascade, you actually kind of shrink the band that you're working in due to something called The Filter Ripley.

And so when you Karski that many, you have to imagine almost as an upside down triangle where the top units. You can go far and frequency, but the lower you go, you need to make sure your frequencies is higher in the center. Again, it's hard to explain. You have to kind of get into filtering at that point, but you will start kind of bringing in the pass band and shrinking it down.

His time, a cascade, and they cascade like 15 of them and they use like 100 foot cables on each one. So you have a loss and like it was just all over the place. So I decided, nope. And I just brought up my battery powered antenna just show. And he says, that's all right.

And do you know the model of that offhand? It's the PSC, RF Malti you can find on eBay for 50 bucks here and there. That would also be great, I think, for those of us who just end up in places where there's no distro. And so you're either gonna have an antenna farm or I guess if you've got your own battery powered antenna distro with you, that would be another solution.

That's really the reason I have with me. But have you run into that situation?

Stephen, what is one book that has been immensely helpful to your audio? Definitely. I still I mean, it was written in the 80s, but I still swear by the the Helma sound reinforcement.

Well, maybe I should look at it again because book, when you were talking about it, I was like, yeah, you know, I looked at that in high school as well. I didn't understand any of it. I just remember the diagram explaining microphone feedback, and that was really helpful. But, um. Okay. You make me want to go back and look at it again. As far as getting into R.F.. The first book I picked up was the A R, L and 10 a handbook.

That one kinda dives into some stuff that really isn't happening in our fields, because when you're talking about antennas that go down to, you know, 20 megahertz or even in the kilohertz, you deal with a lot more like enviromental ground and height above ground and stuff, you don't necessarily deal with as much with low power UHF stuff. But that's a really, really good one. The secrets of RF circuit design is another good one. It actually approaches R.F. with very little physics.

It just kind of gets you the building blocks without diving to heavily the math, because unfortunately, a lot of it is very physics heavy.

We're in a very weird space where you kind of you are grabbing from everywhere from HAMP's the microwave guys.

There's not a lot of books out there that just really say, hey, you're operating wireless microphones and UHF spectrum.

You know, here's how to do it.

That, you know, there's not a whole book or manual written about that. It's kind of grabbed from it. You know, R.F. is R.F.. So it's all the same principles. But just you have to make it apply to you while bringing in from a book about R.F. at 24 gigahertz or maybe a book about this is, you know, two way communication at 147 or whatever. And it just kind of take all of that and bring you into UHF where you're working out because most UHF is is broadcast.

Tell me about what you're listening to this week in Radio Tech.

Okay. It is my favorite one so far. Really? That's fucking awesome. Yeah, it is. It mainly focuses on broadcasts for F m, which is actually really great, though, because a lot of our systems still are f them again.

They're kind of dealing with different things. We're dealing with transmitters were definitely different building blocks using insiders and they're trying to get it broadcast out, you know, to the cars and just radio. But they definitely bring in radio engineers down and they talk about it. It's it's really interesting.

I do follow that one religiously, whereas the best place for people to follow your work Fantana dot com. Well, Stephen, thank you so much for joining me on Sana's on Life. Yeah, this is fun. Sound design.

I really learned a lot in having this conversation with Stephen, so much so that I have asked him to produce a new pilot course with me. It's called Real World R.F. Troubleshooting, and we'll be announcing it in about a week or a week and a half through e mails. So keep an eye on your email to get all of the details about that.