

CHANDLER LIMITED® TROUBLESHOOTING HUM IN MICROPHONES



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INTRODUCTION

Most technical correspondence we receive typically relates to grounding or wiring and the occurrence of *hum* in audio. Grounding, wiring and the mitigation of unwanted hum is an intricate subject, one which this document endeavors to help resolve as it relates to microphones.

Hum plagues every studio, however, while this document is focused on the type related to audio and *ground loops*, it is important to note that there are also the separate conditions of '*physical audible hum*' and *EMI (electromagnetic interference)*.

Microphones are both intrinsically and environmentally sensitive. The greater the sensitivity of a microphone, the more likely it will expose noise inherent in the studio as a whole.

Microphones are very high impedance instruments, and this condition of impedance correlates to the sensitivity and detail of the microphone. However, high impedance devices are more susceptible to hum and *RFI (Radio Frequency Interference)* present in an environment.

REDD and TG microphones are powerful tools for capturing the realism of a source as it is in the room. Reproducing such realism and depth requires microphones capable of capturing a great degree of detail. The REDD and TG microphones are very sensitive devices. Intrinsically, REDD and TG microphones—by nature of their design—can act as scientific instruments, capable of revealing existing studio flaws previously unheard. This information can be a revelation, helping the studio operator to remove the unwanted hum, lower the noise floor and elevate their recording environment as a whole.

NOTE: Many microphones have impedances as high as one billion ohms, and we think of a *one megaohms DI (1,000,000 ohms)* as high impedance!

Physical Audible Hum

All power transformers physically vibrate and may yield an audible hum that could be picked up or recorded by a microphone. The more current a power transformer puts out, the more likely there will be vibration and audible hum. We go to great lengths to minimize physical audible hum, including isolating the power transformer from the microphone's power supply chassis. The REDD Microphone is a microphone and preamp in one and it uses a good deal more current than typical microphones. However, physical vibration and resultant audible hum of the power supply transformer should not be very noticeable, if at all. If you have significant physical vibration and audible hum from the power supply, please contact Chandler Limited.

Differences in Earth or Ground Potential

It's tempting to believe earth and ground are the same everywhere, however, this isn't true. In reality, the distance between earth or ground connection points add resistance between the earth connections of gear. This resistance manifests as hum in the system. For this reason, WHERE YOU PLUG YOUR GEAR IN MATTERS, i.e., where the earth is connected at several points, yet each piece of gear is at a different potential, hum is induced.

For example, the live and control rooms at Chandler Limited's studio are a good distance apart. If we plug any microphone—our vintage M49 is the worst—into the power of the drum room we get hum. When we run an extension cord from the control room to power the mic all hum is completely eliminated. **Why?** It is because they are connected at the same point and at the same potential.

Another example, while visiting a client's home studio, they complained of hum in certain mics—especially ribbons—when used in the small, yet very closely located drum room. Electricians and techs already checked the grounding and found nothing. Wade said, "It sounds like a difference in grounding potential," and proceeded to run an extension cable from where the console was powered to the drum room—the microphones were instantly clean and hum free.

Plugging equipment into the same spot is often called *star grounding*. This is where the ground or earth radiates out from a single point. Star grounding removes loops in the earth connection.

The descriptions above are similar to this, however, instead of creating an intricate earth scheme you are finding where gear is not talking to each other correctly and changing it.

Wiring Standards

Our buildings at Chandler Limited are fairly old. At one point we had issues with random hum throughout the facility. Did it show up when everybody was running their air conditioners? Maybe. Was it at a certain time of day? Possibly.

In an effort to resolve the sporadic hum, electricians came and checked the power in the buildings. It turned out that our two main buildings were wired differently. Also, one building was using a wiring standard where the earth is connected to neutral of the incoming AC. This is an old standard that is now illegal to do...go figure. After rewiring the power, we found our test systems were much more consistent and hum free.

HOW TO TEST FOR HUM

We have a couple simple experiments that we employ for users to test for hum. Hopefully these can help you test for hum with whatever gear or setup you are using.

If you don't want to think about it too much, just begin by attaching an earth lift (ground lift) plug onto the end of the REDD Microphone's AC power cable. The TG Microphone uses an earth lifted AC power transformer thus it only takes ground through the XLR audio jack you connect it to.

A Super Quick Test

Using a ¼" guitar cable—make it short, maybe 3' long—touch one end of the cable to whatever the microphone is plugged into (preamp, converters or mixer) and touch the other end to an exposed metal part of the microphone (paint or anodizing will not conduct). On the REDD and TG microphones, we recommend first touching one of the silver toggle switch batons, then move to the grill and touch there, followed by the body of the XLR connector (not a plastic shell). If hum disappears, there is a ground potential or an earth loop. Similar to the studio stories above, we are creating a simple shortening of the ground by connecting them at the same point.

The body of the XLR is touched because if it is not fully grounded it can introduce buzzing. If the hum gets worse, it also points to a possible earth or ground issue and then other tests must be done. You can perform this test with any piece of gear you own, however, keep in mind that rack mounted gear will most likely be connected to each other through the rack rails. This is also a good test for any gear that uses power packs, as they are often earth lifted and it will tell you if they need an earth or different ground connection.

The ¼" guitar cable test serves another purpose. Although very rare, if the screws are not snug on the body or grill of the microphone, the ground connection to the mic body can be intermittent or lost. This is very uncommon and if it happens it is usually an incredibly loud hum and does not resemble a ground hum—it's way stronger and more irritating. We do not recommend tightening screws without cause, unless you are used to tightening them the proper amount; overtightening can strip the threads of the body. If you attempt this, BE VERY GENTLE AND CAREFUL!

Headphone Amp Test

An important part of finding hums and noises is simplifying the signal path and isolating the gear in question from the rest of the studio. The best way we found to accomplish this is to use only a standalone headphone amplifier and the device in question under test.

Plug the microphone—or other piece of line level gear—directly into the headphone amplifier's left or right master input and listen for hum or noise and set the headphone amplifier for monitoring in mono. We recommend having all other gear turned off, and to have the microphone—or gear in question—and the headphone amplifier plugged into the same outlet or power strip. If the signal is clean, it means the microphone—or other gear—is interacting with your system in some way. You can then reintroduce the microphone to the rest of the studio knowing that the unit isn't malfunctioning and that it is simply an interaction of earth with other equipment.

NOTE: *Be aware that if you plug a piece of rack gear in this way, the input will usually need to be connected, or terminated, or it can act like an antenna inducing hum and RF.*

Headphone Amp Test Story

A client purchased a REDD Microphone that had been working fine and one day complained of hum. The headphone amplifier test was employed to isolate the REDD Microphone and observe its audio output. The headphone amplifier and REDD Microphone were plugged into the same side of the room as was all the rack gear in the studio including the console. Hum was present. Noticing an AC jack on the other side of the room, we asked if the headphone amplifier and REDD Microphone could be plugged in there. Once the headphone amplifier and REDD Microphone were connected to the other wall, the hum was gone. Though the REDD Microphone wasn't the culprit, it was telling us that something else was wrong in the studio's environment. Armed with this knowledge, we plugged the test setup back into the gear side of the room and began shutting down one piece of gear at a time while listening in the headphones to the REDD Microphone. As gear was shut down, layers of noise began to lift, however the hum persisted. After turning everything off in the studio, except for the recording console, the hum was still present. The studio owner turned off the recording console and the hum was gone! As it turns out, the culprit was the wrong gauge AC cable—too thin—being attached to the recording console's power supply. Once the power supply cable was replaced with the correct gauge type, the hum was gone and the studio's noise floor dropped too!

SERVICE

IN CLOSING

If the unit has hum, try the ground lift and 1/4" guitar cable test. These tests will often show that the earth needs to be lifted, that hum exists in the overall system, or that your mic may need to be checked. It is quite rare for a microphone to hum because it is malfunctioning, however, we are happy to help in any way including checking your microphone in our shop.

At Chandler Limited we are proud of our American made products and we hope you like them!

Please feel free to call our shop anytime for help or questions.

Phone: (319) 885-4200.

United States

Prior to sending in equipment for repair, please contact our shop at the number below. We will assist you in troubleshooting, and if needed, we will issue an RMA# to return the equipment for service.

Send Repairs To:

Chandler Limited, Inc.

Attention: Repairs

222 S. Cherry St.

PO Box 38 (if sending via the postal service)

Shell Rock IA 50670

Phone: (319) 885-4200

Email: support@chandlerlimited.com

International

Repair of Chandler Limited products purchased, outside of the United States, is provided by local or regional authorized Chandler Limited distributors. To obtain service or repairs, please contact your local dealer or regional distributor for further instruction.

Visit chandlerlimited.com for a list of authorized International Distributors.