Personal PA® Technical Bulletin

Remedies For Buzz or Hum in Sound System or PPA

TECHNICAL BULLETIN

If you experience a buzzing or humming noise in your sound system when the PERSONAL PA Transmitter is plugged into AC power, you have a radio frequency (RF) feedback problem.

Several effects can be induced into small commercial public amplifiers by radio frequency energy. Effects include audible buzz, oscillation, reduction in gain, distortion, and various noises. It is the purpose of this Technical Bulletin to discuss interference caused by Williams Sound Hearing Assistance Transmitters. However, many other sources of RF energy can cause the same effects, including CB radios, radar systems, VHF-FM transceivers, AM, FM and television broadcast transmitters, and many non-radio devices. The same measures that correct interference from Williams Sound transmitters can also correct interference from other RF energy sources.

Cause of The Problem: Poor RF Resistance

Generally, an RF field has to be relatively strong to cause undesirable effects in PA amplifiers. Powerful broadcast transmitters do not have to be nearby to cause problems. Williams Sound transmitters are especially low power transmitters, but are often installed quite close to a PA amplifier. Thus, they can sometimes cause more undesirable noises than a distant transmitter of much higher power.

The RF power produced by Williams Sound Hearing Assistance transmitters is very small, less than 20 milliWatts. For amplifiers to be affected by this low power, they must be especially sensitive. Amplifiers with ordinary bipolar transistors but with little or no provision for RF suppression can be very sensitive to interference.

The best way to avoid RF interference is to use only audio equipment designed with adequate RF protection. For example, the audio circuitry in radio transmitters, including those from Williams Sound, performs flawlessly—even though it is installed on on the same circuit board as the radio transmitter circuitry.

Thus, every provision has been made in the design of Williams Sound transmitters to control unintentional RF emissions. But since RF currents do flow, we recommend installing wiring during installation that controls RF currents and minimizes interference.

Minimizing RF Infiltration

RF energy is usually conducted into a device on any of the conductors entering its chassis. Energy gets on these conductors in two ways: by picking it up like an antenna, and through conduction from devices with RF voltage on their chassis.

Reducing RF Current In Monopole Antenna Installations

The amount of RF energy available on a transmitter chassis is greatest when a monopole antenna is used right on top of the transmitter. RF current flows from the transmitter output circuit into the base of the antenna while an equal and opposite current flows onto the chassis of the transmitter. Often, the only place for the chassis current to go is along the connecting wiring to a nearby public address amplifier or other audio device.

In these instances, the best way to minimize the RF current flowing into an amplifier is to provide an alternate path.

For example, if your transmitter is installed in a steel equipment rack, you could connect a short, heavy conductor directly from the transmitter chassis to the rack rails.

If your transmitter is not rack-mounted, you could connect a short, heavy conductor directly from the transmitter chassis to an electrical conduit. The connection to a conduit should be substantially shorter and heavier than the connection to the amplifier.

Reducing RF Current In Balanced Antenna Installations

Using a balanced antenna, like a dipole, reduces the RF current flowing onto the chassis of a transmitter; it goes to the second element of the antenna instead. Dipole antennas are usually larger than monopole models and are connected by means of a coaxial cable. This makes it easy to install the antenna at a distance from the other audio equipment.

In these situations, RF gets into the other equipment primarily through the power cord, speaker wires, or unshielded audio inputs, all of which can act as antennas. Below are recommended solutions, starting with the easiest, external fixes.

Important Note
In the instructions that follow, we suggest installing bypass capacitors in sensitive audio devices. Williams Sound assumes no responsibility for any resulting damages. The work should be done only by a qualified electronics technician. You are responsible. If there is any doubt as to being successful, contact the manufacturer of the equipment

When installing capacitors, it is very important that the shortest possible lead length be used. At RF frequencies, long wires have considerable inductance, rendering anything connected with them ineffective.

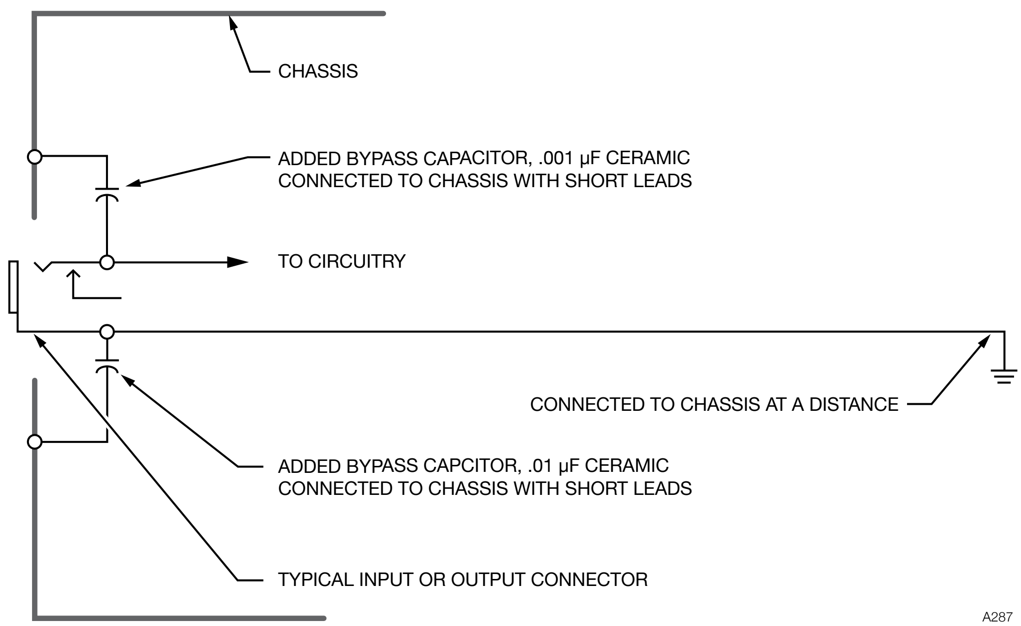
Using Bypass Capacitors

Modifying Signal Connections

RF interference is often a problem where input and output connectors are mounted on a printed circuit board, and where the ground pins of the connectors not connected to the chassis with a short, heavy circuit path.

Every conductor that enters the chassis of an audio device is a potential RF path. A conservative approach would be to install bypass capacitors on every connector as shown in Figure 1. This can be a large and time consuming project, however. Instead you might install capacitors only at those jacks which are at fault.

Figure 1: Bypass Capacitors On Every Connector



Speaker Terminals

Speaker terminals should be handled like low level signal connectors. However, it is important to use capacitors with voltage ratings substantially higher than the terminals' expected peak voltages. For example, with 70 V speaker lines, use 200 V or greater parts. On a transformer-coupled speaker output, the common terminal should be bypassed with a capacitor, directly to chassis, with short leads.

Ground Terminals

Some amplifiers have a ground terminal located with the speaker terminals and commonly connected to the chassis with a long wire inside the unit. Bypass this terminal with a capacitor.

Power Connections

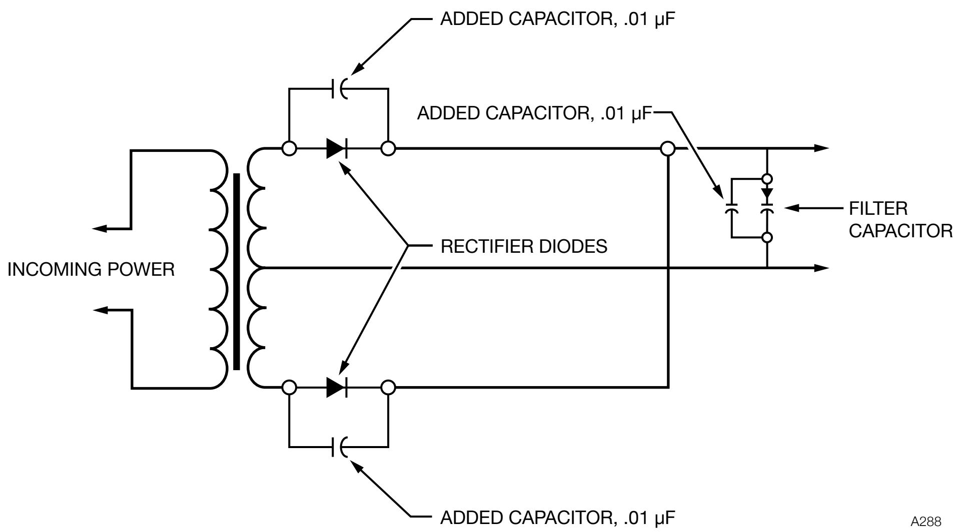
Sometime RF energy enters by means of the power cord. **DO NOT BYPASS THE POWER CORD.** This is not recommended by Williams Sound **AND** would render any safety approvals void. It is dangerous.

A different, more effective means can be used: Install a capacitor in parallel with each rectifier diode in the power supply as shown in Figure 2. In addition, install a capacitor in parallel with each filter capacitor in the power supply.

Transmitter Chassis Bonding

When installing the transmitter, use an ohm meter to make certain of a good electrical connection before attaching any wiring. Often, paint build-up prevents a good connection between the transmitter chassis and rack. If necessary, scrape paint from the transmitter or rack to achieve a good connection. By using a star lock washer and tightening the mounting screws firmly, you can achieve a long lasting connection.

Figure 2: Installing Capacitors In Parallel Rectifier Diodes In Power Supply



Practical Example

At Williams Sound, a commercial PA amplifier was shown to be very sensitive to RF disturbances. Engineers were able to completely eliminate all of the evident RF induced disturbances by adding six small bypass capacitors and one short wire jumper. No improper operation of any kind was observed after the modification.

Three of the capacitors were installed in the power supply. Because the power supply had no other provision for suppressing rectifier hash, the modified amplifier exhibited a quieter noise floor after the modification—even with RF in the area—than it did before the modification with no RF in the area.

If you have any questions regarding this information, please contact Williams Sound at:

1-800-843-3544

WILLIAMS SOUND ®

10300 Valley View Rd • Eden Prairie, MN 55344
800-328-6190 / 952-943-2252 • FAX: 952-943-2174
www.williamssound.com

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