

# Choosing Effective FM Technology Solutions for Students who are Hard of Hearing

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## Abstract

Disabled student service providers and vocational rehabilitation counselors are on the 'front line' addressing the needs of individuals who are hard of hearing. You are the professionals who need to understand the communication obstacles and introduce technical solutions and other support services to students who are hard of hearing. It often falls on you to also train and counsel individuals on the use of these services and technology.

Understanding the relationship between hearing instrument options and FM system options can mean the difference between successful communications and unnecessary hardship for the hard of hearing student. This workshop will help you understand this critical relationship and enable you to more confidently choose effective FM technology.

## Introduction

I'd like to begin with a brief introduction. I am not a vocational rehabilitation counselor, although I work extensively in that arena. I am not an audiologist, even though I talk about hearing instruments. I am an ALD (assistive listening device) specialist. My experience and focus is meeting the needs of individuals who are hard of hearing, people who rely on their residual hearing, and who do not know sign language and who probably wear hearing aids. I support vocational rehabilitation professionals and audiologists with technical expertise in using ALDs to meet the

needs of individuals who are hard of hearing. Excellent technical resources are available that discuss FM systems and listening options. Those of us who love details get excited when we find these highly technical and thorough references. My purpose today, however, is to take that information and present it in a practical format so that anyone, regardless of their technical experience level, can leave this workshop feeling they can more competently support this technology.

After polling the audience for technology comfort levels, I see the experiences range from novice to knowledgeable. This diversity often makes it difficult to meet everyone's needs when discussing technical issues. It is my experience to have everyone 'read the menu', start with an appetizer, and then get to the 'meat and potatoes' that the more experienced folks crave.

When discussing FM systems, it's wise to remember that one size does not fit all. You can't purchase one system with a single option and expect it to meet everyone's needs. There are three groups of individuals who can benefit from assistive listening systems: people with hearing loss who do wear hearing aids, people with hearing loss who don't wear hearing aids and people with central auditory processing disorders. The method of interfacing with the assistive listening system determines how effective that system will be for each individual.

You cannot successfully choose technology without considering four key environmental issues and the strategies for recognizing them:

Environmental Strategies—recognize unfavorable listening situations in the classroom:

1. Room acoustics (large hall, open windows, air conditioners and outside noise) can make it more difficult to hear clearly in the classroom.
2. Seating (distance from the speaker, seating arrangements) can cause difficulty for a student with hearing loss.
3. Teaching style (lecture, class discussion, group discussions) can adversely affect one's ability to hear clearly.
4. Use of audio-visuals, while an excellent tool, can cause difficulty if the speaker tries to speak above the hum of the a/v equipment or with the room darkened.

Communication Strategies can also affect successful use of technology:

1. Face the audience and keep things away from your mouth.
2. Don't speak while looking down or with your back turned, and don't roam the room while speaking.
3. Repeat questions from the class before answering them.
4. Don't publicly draw attention to the person using the technology; devise inconspicuous hand signals prior to class to communicate about the technology.

Just how does an assistive listening system help?

ALDs produce a favorable speech-to-noise ratio by placing the microphone near the desired sound source. They overcome reverberation and background noise in acoustically unfriendly rooms and add amplification of the sound source when needed. An assistive listening system consists of two units. One unit has a microphone clipped to the lapel of the instructor (the transmitter). It transmits the sound signal to the other unit (the receiver) that is worn by the student. The receiver converts the signal back to sound that is delivered to the ear with a listening option.

This system can transmit the sound signal three ways. We are only addressing one system, FM systems, throughout this workshop because these are most prevalent. The FM system uses a radio frequency to transmit sound from the transmitter to the receiver. These frequencies are different for each ALD manufacturer.

## FM System Listening Options

There are five basic FM system listening options (or interfaces).

- **Headphones**—standard headphones that fit over the head (and don't appeal to many students).
- **Ear hook**—basically half a headphone that fits over one ear with an adjustable hook. It is more appealing because it is more discreet.
- **Neckloop**—this wire loop fits over the neck and creates a special signal that a hearing aid telecoil can pick up. It allows the hearing aid to use its full power.
- **Direct audio input**—connects the hearing aid directly to the FM system.
- **Earbud**—this single earbud fits snugly in the ear, in place of a hearing aid.

## Hearing Instruments

Hearing instruments come in three basic styles. A hearing aid consists of a microphone that picks up all sounds, the circuitry that takes that acoustic sound and amplifies it at the levels necessary for that individual, and the style of aid that gets the sound into the ear. Our goal should be to maximize the use of the hearing instrument by interfacing it most effectively with an FM system.

- **CICs**—the very smallest instruments that fit completely-in-the-canal and are virtually invisible.
- **ITEs**—instruments that fit in the ear; the largest fill the bowl of the ear.
- **BTEs**—instruments with an ear mold that fits in the ear and is attached to the aid that is behind the ear.

## Hearing Instrument Options

Generally, ITE and BTE aids have options available that allow them to interface with an FM system. The telecoil is often a misunderstood option. The benefit of the telecoil is to turn off the hearing aid's microphone in listening situations where the aid does not perform optimally and pick up sound in a different way. Here is my basic definition of a telecoil:

A telecoil is a special circuit in the hearing aid that allows it to pick up sound differently than the microphone. Typically, you turn off the hearing aid microphone to turn on this special circuit. When you turn the telecoil on (also called t-switch or telephone switch), it is looking for a special electromagnetic signal. This signal will come through many telephone handsets and through the neckloop option of an FM system. It then converts the signal back to sound. This telecoil often is not as strong as the hearing aid microphone and users need to turn the volume control up in order to hear sound at the same level they perceive sound through the microphone.

Telecoils are not made alike, and there is an excellent article that discusses telecoils in great technical detail listed in the references.

Another hearing aid option is direct audio input or DAI. Direct audio input lets the hearing aid microphone remain on while also directly connecting the hearing aid to the sound source. This allows a more distortion free sound signal and is very beneficial for people with severe hearing loss or those in computer classes. There is a special boot that snaps onto the bottom of BTE hearing aids and connects a cord from the hearing aid to the FM receiver.

### Putting the pieces together

We've discussed FM systems and FM listening options. We've also discussed hearing aids and hearing aid options. Now it is time to revisit each FM listening option and discuss how best to interface it with the hearing aid.

**Headphones** are for mild to moderate hearing loss. They can be used with no hearing aids, CIC hearing aids and some ITE or BTE aids that do not have telecoils. They may cause feedback (or squealing) to occur at higher volume levels as well as sound leakage. This sound leakage can cause distraction to others sitting around the individual, so you should monitor this during the system test. This option presents sound binaurally (to both ears).

**Ear hooks** are also for mild to moderate loss. They can be used with no hearing aids, CICs, most

ITEs, and BTEs that do not have telecoils. They may also cause feedback and sound leakage at high volume levels which can cause distraction to others. This option presents sound monaurally which may not be comfortable to some people. The ear hook is sometimes effective because it does not set snugly on the hearing aid and the possibility of feedback is lessened. It allows sound to go to one ear while leaving the opposite ear open to environmental sounds with the hearing aid microphone turned on.

**Neckloops** are for moderate to severe hearing loss. They can only be used with ITE or BTE hearing aids with the telecoil option. This is effective for people with more severe hearing loss because it bypasses the hearing aid microphone, eliminating the possibility of feedback and sound leakage. It allows for binaural listening and the full power of the hearing aid. Silhouettes are another option and fit behind the ear to bring that electromagnetic signal even closer to the hearing aid's telecoil. These two options use induction to transmit the sound from the receiver to the telecoil.

**Direct Audio Input** is for severe to profound loss. The boot and cord snaps onto the BTE hearing aid and plugs directly into the FM system. It provides a direct connection and allows the hearing aid microphone to remain on (to pick up environmental sounds) while also picking up the FM system signal. The FM signal will come in at the same level as the hearing aid microphone to give you the benefit of both signals. Another option similar to DAI is a cochlear connector cord that runs from a cochlear implant user's speech processor to the FM receiver.

**Earbuds** are used in place of a hearing instrument. If an individual's hearing aid has feedback and no other option is available to effectively interface with the system, then the earbud is an effective option. Sound goes directly into the ear, usually without sound leakage, with a snug fit. The drawback to this option is that we are unable to maximize the benefit of the hearing aid.

### Conclusion

You should now have a grasp of the terminology of hearing instruments and assistive listening system options. You have seen hearing instruments up close with the visual display board that was

passed around the room. You are now in a position to look at product information and understand how it works.

I'd like to summarize with a few thoughts about protecting and maximizing your investment in assistive listening systems. When I work with disability service providers, I request details of all the systems owned by the school. This information helps me recommend how to use your systems most effectively and build in flexibility. I've shared a copy of this form with you because you will find it helpful in managing your inventory and documenting system maintenance.

In closing, I want to stress that a basic understanding of how this technology works is all you need to enable you to competently support your students. You don't have to become a technical expert. You only need to know enough to talk with those experts. I invite you to add me to your list of resources anytime you have technical questions. You can also call the manufacturer directly with any questions you have. You also have excellent resources available to increase your technical understanding.