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Wireless Microphone Systems

Wireless microphones are a very popular item in church audio systems today. As with most products, there is a wide range of products available, both in price and in quality. There are many aspects of a wireless system that should be considered when choosing a system. We will look at the most important aspects in this discussion.

Frequency of Operation

The user must realize that a wireless system is really a mini radio station. The microphone, be it a clip on lapel or hand held type, feeds your voice into a transmitter, which transmits via the public airwaves to the system receiver. The audio output of the receiver connects into the sound system the same way any other microphone does. With a lapel mic, the transmitter is a separate belt pack type unit. With a handheld mic, the mic and transmitter are integrated into the handheld case.

Because the public, regulated by our government, technically owns the airwaves used for transmission it is not possible to guarantee absolutely interference free wireless performance. The radio spectrum is very crowded today, especially in large cities, and it is possible that someone near you will be using a wireless mic or some other wireless device on or near the same frequency you are using. A church can apply to the government, Industry Canada Communications Spectrum Management, for a licence for a particular frequency, but this will not guarantee freedom from interference, and most churches do not go to the trouble of licensing.

Because virtually all of the wireless systems sold in Canada are made off shore, the frequency bands used are those dictated by the FCC in the USA, as that is the single largest market for wireless. It happens that the bands used in the USA are allocated in Canada to broadcasting (television channels 7 through 13), fixed and mobile use, with broadcasting as the primary use. This means that provided a user has a system that is not on a nearby television channel, there will not likely be any trouble.

The frequencies used in television channels 7 to 13 are from about 174 MHz to 215 MHz. This is known as a part of the VHF band. Today, many manufacturers of wireless systems are also using UHF frequencies, in the 600 to 750 MHz range. This ultra high frequency range is not nearly as crowded as the VHF area, and so freedom from interference is greater, depending on the quality level of the system. It is important that the company selling the wireless system understand the forgoing and checks with the client before the purchase about where the system will be used. Horizon Audio has government charts and frequency listing books to help determine a good frequency to use in a given area.

When more than one system is to be used in the same location, each system must be on its own frequency. It is possible for one system to interfere with another even when each system by itself may operate fine by itself. Frequencies for multiple systems in one location must be carefully chosen.

Type of System

There are really three basic types of systems available: portable, permanent installation, and single location/multi system. It is generally true that portable systems are thus because they are the least expensive. Portable systems, other than those designed for broadcasters, are small, lightweight, usually have plastic cases, and have attached whip antennas. These systems are designed to be inexpensive and portable. They will work in a permanent situation, but do not have the features that allow you to easily install the receivers in a rack or cabinet. They must be left sitting out on top of a shelf or cabinet.

Permanent installation systems have detachable antennas, usually metal cases and often have rack-mounting accessories. These systems are usually higher priced than portable systems, and therefore have better RF (radio frequency) and audio performance. These systems also usually have meters for audio and RF levels.

Single location/multi system models are very expensive, as they are designed to work together in one location, often with many other systems at one time. These systems can cost over \$5,000.00 each and are, therefore, not popular in churches.

System Use

Systems are generally designed for three uses: instrumental, vocal and speech. Instrumental systems accept signals from a guitar. Vocal systems have an integrated handheld microphone and transmitter. Speech systems have a clip on lapel microphone that feeds the beltpack transmitter. Now adays, many users are choosing to go with a head mic, rather than the lapel mic, because of ease of use, and it results in better quality sound all the way around.

Most transmitters have a gain control to accommodate a wide range of input levels. Some belt pack transmitters can be easily adapted to be used with guitars.

Diversity / Non Diversity Reception

Most people think of a radio receiver as having one antenna. However, there is a phenomenon that can happen with a one-antenna receiver called multi path reception. Visualize the direct path between the transmitter and receiver antennae: now think of a second path; from the transmitter antenna to a nearby metal object and then to the receiver antenna. Because the second path is longer due to the reflection, the two signals will not be in the same time relationship (phase) when they meet at the receiver antenna. Chances are the two signals will partially cancel out each other with a resultant momentary drop in signal strength. What you hear is a sudden increase in background noise as the signal strength drops. Sometimes the signal will drop out completely. We refer to this as an RF hit.

In an effort to minimize or eliminate this phenomena manufacturers developed two antenna systems, termed diversity reception. There are a number of diversity systems, but most are effective if properly implemented. The idea essentially is that with two antennas, spaced more than 1/4 wavelength apart at the operating frequency will prevent RF hits because when a reflected signal is at one antenna out of phase with a direct signal, it will almost certainly not be out of phase at the other antenna. The result is dropout free performance.

Some manufacturers still offer non-diversity systems, however, our view is that with the minimal difference in price, the consumer is wise to invest that little bit more money and have 'dropout insurance'.

Receiver Sensitivity and Selectivity

These are two important aspects of the receiver that indicate system quality. Sensitivity refers to the strength of the incoming signal the receiver is able to pick up with a reasonable signal to noise ratio. The more sensitive the receiver is the farther away the transmitter can be.

Selectivity refers to the ability of the receiver to pick up its own frequency while rejecting others close by. The more selective receiver will have more filtering in its front end and will be a more expensive system.

Tone Coded and Digital Squelch

Some systems employ methods to make them less susceptible to interference. If your transmitter happens to be off while the receiver is on, the receiver is free to pick up any signal that may come along on or near the system operating frequency. When your transmitter is on, the receiver 'hears' its frequency and locks on to it. Tone code squelch is a method that prevents the receiver from 'hearing' others signals when its own transmitter is off. The transmitter sends a sub audible tone along with the audio. The receiver squelch circuit will not turn on unless that tone is present. If no tone is present in the transmission you will not hear anything. Digital squelch is the same idea, however, a digitized code is transmitted, making this a more secure system than a system with simple tone code squelch.

Note that once your transmitter is on and your receiver has opened up and is receiving it, an interfering signal on or near your frequency can still interfere with you.

Frequency Agile Systems

In an attempt to make systems more trouble free, manufacturers have developed systems that give the user the ability to change their frequency of operation. This is known as frequency agility, as opposed to fixed frequency systems. There are two methods used to provide agility. One method is to have a synthesizing circuit that generates a band of carrier frequencies. The other method is to have individual crystals for each frequency. A synthesized system is less costly to manufacture than a crystal controlled system. Put another way, if two systems are the same cost, the synthesized system will not usually perform quite as well. Crystal control is more stable in the long term than synthesis. Most synthesized agile systems work in the UHF frequency range. The strong trend in the industry today is to these synthesized UHF systems.

The Battery

The freedom of a wireless microphone system comes with a cost, besides the transmitter and receiver; the transmitter must have a battery in it! Most complaints about wireless performance we receive are due to people trying to operate the transmitters with a battery that has dropped too low in voltage. Most systems use either 9 volt or 'AA' size batteries, and we highly recommend alkaline or the new lithium type units. With 9-volt batteries, once the voltage drops down below about 7.3 volts the audio quality will begin to deteriorate and the battery should be replaced. Don't throw out those used batteries though; there is still plenty of life in them for other things. Put them in a box in the lobby and invite people to take them home for toys or smoke detectors etc.

System Cost

Today, systems are available from about \$100.00 to several thousand dollars. As with most other products, the more you invest the better quality you will receive. In our opinion no church should consider a system below about \$500.00 regular selling price, and then only if they absolutely must have a wireless but don't have any more money. At the higher end, most churches really do not need to invest any more than \$1,500.00 to \$2,000.00, unless they have unique requirements such as high quality recording or professional broadcasting.

We hope this brief discussion of wireless microphone systems will help you in deciding what you should do. Wireless microphones are very popular and can be an effective ministry tool, however, we cannot emphasize enough that the more money you invest, the happier you will be for a longer time period with your purchase. We have replaced many \$100.00 to \$400.00 cheap systems.

We have a policy of making various models available for trial if you wish to do so before making your decision. Please feel free to call us with any questions not answered here. Thank you for your consideration!

ORIGINALLY COMPOSED BY DAVID WETTLAUER
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