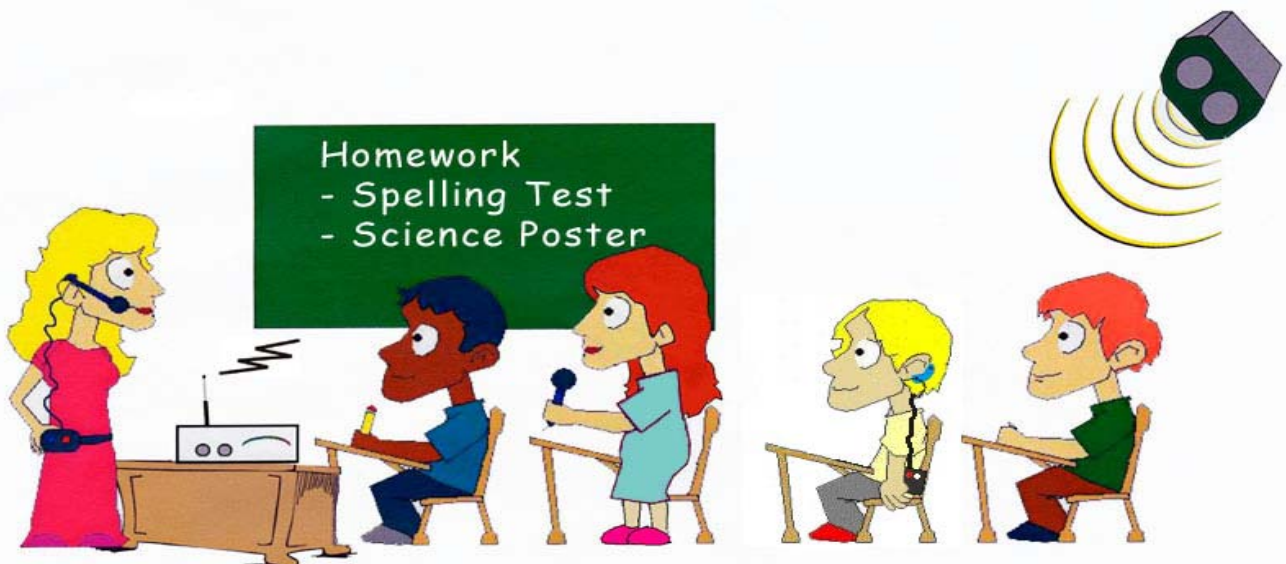


Sound-Field Systems Guide for Classrooms



SOUND-FIELD SYSTEMS GUIDE FOR CLASSROOMS

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May 2004

Graphic Design by Helen Oldham

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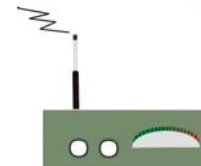
I. INTRODUCTION

This guide can be used to assist school administrators, parents and teachers in making an informed decision regarding the purchase of suitable sound-field systems. Information in this guide is based on feedback and informal classroom assessment received from teachers and students in the Edmonton region. This feedback formed part of a study on sound-field amplification systems conducted by Alberta Infrastructure in collaboration with educational audiologists from the Edmonton Public School Board, an independent technical consultant and electronics personnel from the Edmonton Catholic and Public School Boards.

II. WHAT ARE THE COMPONENTS OF A SOUND-FIELD SYSTEM?

A sound-field system consists of the following components:

- ✓ **Microphone** for the teacher
- ✓ **Wireless transmitter** worn by the teacher
- ✓ **Hand-held microphone** for students (optional)
- ✓ **Battery/Charger**
- ✓ **Wireless Receiver/Audio Amplifier**
- ✓ **Loudspeakers**



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All of these components commonly are used in a variety of commercial sound system applications. Local vendors will sometimes assemble the various components to create a unique classroom amplification system. These customized systems can work well in classrooms, although consistent performance and compatibility between components is not assured. Success depends on the knowledge and experience of the vendor in selecting and combining the most appropriate components. Customized systems vary widely in cost depending on the quality of the equipment.

Sound-field systems are also available from manufacturers that have intentionally designed a complete system for classroom amplification. **Purpose-designed systems have many convenient features and options that address specific teacher and student needs.** Individual components are designed to work together as a complete system, thereby eliminating compatibility concerns. While these systems typically cost more, they are usually a good choice.

III. WHAT ARE THE IMPORTANT CONSIDERATIONS FOR EACH COMPONENT?

Cost is often the major purchase consideration but it should not be the only basis on which a system is chosen. **To be an effective teaching tool, each component of a sound-field system must also be easy to use, sufficiently durable to withstand daily operation, and contribute to consistent high-quality sound.** The following sections describe some of the key functional aspects important to long-term performance and usage.

1. Microphone for Teachers

One of the most critical components of a sound-field system is the teacher's microphone. While performance in the classroom is largely determined by the microphone's audio characteristics, it is just as important that the teacher can wear the microphone comfortably all day. If the microphone pinches or does not stay in place, the teacher will likely decide not to use the system.

Two styles of microphone commonly are used. They are referred to as a headset microphone and a lapel microphone. **Headset microphones are the preferred choice for sound-field applications** but finding a proper fit requires some trial and error evaluation. Lapel microphones are easy to wear but do not perform as well in the classroom.

Headset Microphone



Headset microphones, also known as boom microphones, are often used by entertainers. Most headset microphones consist of a band that fits over the ears and around the back of the head. Attached to the band is a flexible boom with a microphone located on the tip. **The main advantage of the headset style is that the microphone follows the teacher's head movements.** This keeps the amplified voice levels consistent at all times.

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It is important that the headset accommodates many different head sizes and hairstyles.

The best method of evaluating the fit and comfort is to obtain samples of different headsets from a vendor. Have several teachers try the headsets to make sure there are sufficient adjustments and no pressure points. Headsets may need to be worn for a full school day to provide an accurate indication of comfort.

Check that the microphone boom can be positioned properly. Some microphones work best when placed directly in front of the mouth while others are intended to be positioned slightly off to the side, near the cheek. Ideally the microphone should be worn 3 to 5 centimetres away from the mouth. If positioned closer than this, there will be excessive breathing noises and over-emphasis of 's', 'p' and 'th' sounds. Once positioned by the teacher, the boom should stay in place. A boom that sags continually is a nuisance.



Look for . . .

- ✓ "headset" style
- ✓ comfort
- ✓ adjustability
- ✓ unidirectional pick-up
- ✓ front of mic clearly marked
- ✓ replaceable wind screen
- ✓ garment clips on cable

The microphone on the tip of the boom must have a unidirectional pick-up pattern. A unidirectional microphone is much more sensitive to sounds coming from the direction of the teacher's mouth. This helps to suppress feedback. The microphone should be clearly marked to show what direction it should face. Omni-directional microphones must be avoided, as they pick up sound equally from all directions and result in feedback squealing.

Most microphones are covered with a porous, foam windscreen to help reduce breathing noises. Hygiene is a concern with windscreens because they can harbour germs and absorb odours from perfume and makeup. Microphones are often shared with substitute teachers or student teachers, so it is important to **ensure that the windscreen can be easily removed and that inexpensive replacements are readily available.**

Microphone cables can be a common source of frustration because they frequently get caught on desks and other classroom objects.

Cables that incorporate two or three garment clips solve this problem. Garment clips keep the cable close to the body, thereby reducing the likelihood of it becoming entangled or snagged.

Lapel Microphone

A lapel microphone is clipped to a shirt or blouse and positioned slightly below the chin. Television newscasters often use this style of microphone because it is visually unobtrusive. Teachers may prefer a lapel microphone because it is comfortable and does not interfere with hairstyles. However, a lapel microphone has several significant disadvantages when used for classroom amplification.

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Most importantly, it results in inconsistent amplification because the microphone does not remain at a fixed distance from the teacher's mouth at all times. Lapel microphones are also prone to shifting position or being covered by clothing. These factors lead to marked variations in the teacher's amplified voice level under normal teaching conditions.

Feedback is another concern. If the teacher moves too close to a loudspeaker or if the microphone is positioned incorrectly, feedback can suddenly occur. To avoid this, teachers often will reduce the volume of the amplified sound. In some cases, the volume must be turned down so low that the benefit of a sound-field system is lost. Choosing a microphone with a unidirectional pick-up pattern will help with this problem but **a lapel microphone is far more susceptible to creating feedback compared to a headset microphone.**



2. Microphones For Students

An increasingly popular option is a second microphone for the students. In fact, many teachers feel that student microphones are an essential component of a sound-field system. **The greatest benefit of a student microphone is that it allows the entire class to clearly hear student presentations and answers.** Even very quiet voices can be heard. Since the microphone is handheld and wireless, it is completely portable and can be easily transferred between students.

Ideally, a handheld microphone should be ergonomically designed for student use. This means a smaller diameter for small hands and a lighter weight compared to a conventional handheld microphone.



Robust construction with a metal body and windscreen are important durability characteristics. A faceted collar that prevents the microphone from rolling off desks is another important durability feature.

Batteries are contained within the body of the microphone. Check for the ease of removing batteries. With some microphones this can be a challenge.

The major drawback of student microphones is the cost. A handheld wireless microphone option will increase the cost of a system by 30 to 40 percent. Doubling the number of microphones in each classroom may also reduce the total number of sound-field systems that can be installed within a school. (See also Section IV “Choosing the Right Wireless Technology”.)

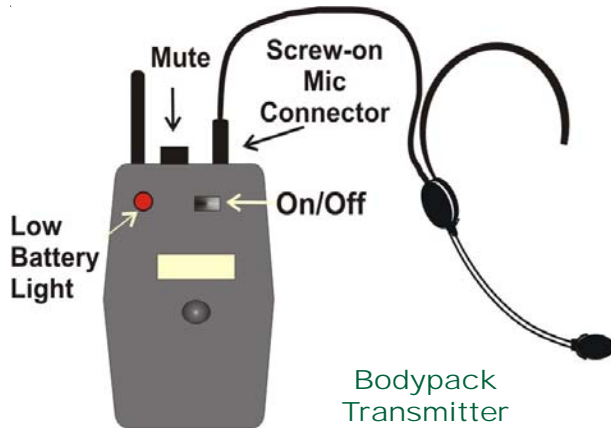
Look for . . .

- ✓ easy to hold
- ✓ unidirectional pick-up
- ✓ anti-roll design
- ✓ durable construction
- ✓ easy battery removal

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3. Transmitter

Transmitters are almost universally a “bodypack” design that contain the batteries and electronics required for transmitting the microphone signal. The bodypack is either clipped to the teacher’s belt or placed in a pouch and worn with a strap around the waist.



Transmitters damage easily if they slip off and fall to the floor. Check that the belt clip holds the transmitter firmly in place.

Pouches should be form-fitting so that the transmitter does not shift inside the pouch or fall out when the teacher bends over. Cutouts in the pouch should expose any indicator lights or other controls on the transmitter that must be accessed regularly. Waist straps for pouches must be comfortable, easy to adjust and have quick release clips.

Sound-field systems designed by manufacturers typically provide good-quality accessories, like pouches, that are functional and compatible with their products. Accessories supplied with sound-field systems, assembled by local contractors, are not necessarily so well thought out. In some cases, the accessories are generic in design and may not perform adequately.

Transmitters usually have numerous control buttons, although only a few need to be used by the teacher. In fact, most of the controls should be inaccessible or have the option to be locked out to avoid accidental adjustment. Only an **On/Off** switch and sometimes a **Mute** button will be used regularly.

Some teachers find it necessary to mute the system frequently when working with individual children where it is inappropriate to amplify the conversation. Transmitters with a mute button allow the teacher to temporarily interrupt the sound. **A good mute button should be easy to find and use.** The best mute buttons are relatively large and are located on the top of the transmitter. A latching action on the button is preferred so the teacher does not need to hold the button down continuously while muting. Not all transmitters have the mute function, particularly those supplied in

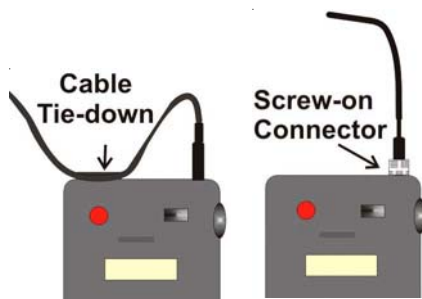
Look for . . .

- ✓ form-fitting pouches with cutouts for controls
- ✓ snug belt clip
- ✓ mute button
- ✓ secure microphone connection
- ✓ 6-8 hour battery life
- ✓ low-battery indicator light
- ✓ easy battery removal
- ✓ lock-out for controls

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contractor systems. The On/Off switch is usually not a good substitute for a mute because it can create loud noises when activated or it may have a delayed response. However, if muting is only required occasionally, as when the teacher is leaving the classroom, then the On/Off switch can serve this function reasonably well.

The jack that the microphone cable is plugged into is a weak point of some transmitters. Continual movement at the jack loosens the contacts or weakens the cable, making the microphone operate intermittently. **A good transmitter will have a screw-on locking microphone connector or some other means of securing the cable near the jack.** Designs that prevent the cable from flexing at this point are much more durable and reliable.



Examples of good Mic connections

Keeping the battery charged is an important daily maintenance activity. **A fully charged battery should be able to power the transmitter throughout the full school day (approximately 6-8 hours).** Not all transmitters will last for that period of time. A very useful feature is a low-battery indicator light which provides advance warning.

Many transmitters require the batteries to be removed and placed into a charger. Check for the ease of opening the battery compartment and removing the batteries. The most convenient transmitters, typically found in manufacturer-designed systems, do not require the batteries to be removed at all. At the end of the day, the entire bodypack is simply placed into the charger to ready it for use the next day.

4. Battery /Charger

Almost all systems use rechargeable nickel metal hydride (NiMH) batteries. These batteries are the preferred type because they can be recharged at least 500 times and they do not develop a memory. Each classroom should have two sets of batteries so that one set is always ready.

Since it is a daily requirement, **charging the batteries should be a convenient process that avoids extra steps.** For example, inexpensive chargers often operate on a simple timing cycle that requires the charger to be unplugged momentarily to initiate a new charging cycle. This step is easily forgotten and results in uncharged batteries the next day.

 **Look for . . .**

- ✓ NiMH batteries
- ✓ convenient charging
- ✓ “smart” charger

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The best chargers, often referred to as “smart” chargers, are completely automatic. They monitor the battery condition and alter the charging cycle appropriately. Batteries charge quickly and have longer life. Smart chargers are more expensive than the simple timer-controlled products but the convenience and extended battery life usually justify the extra cost.

5. Wireless Receiver/Audio Amplifier

The **Wireless Receiver** picks up the radio signal from a corresponding microphone transmitter. Each receiver and transmitter pair operates on a unique channel so that there is no interference between classrooms. The number of channels that can be used within a school ranges approximately from 16 to 80. (See Section IV, “Choosing the Right Wireless Technology” for more detail.)

Look for . . .

- ✓ output for Personal FM System
- ✓ separate volume control for each mic
- ✓ bass and treble controls
- ✓ lock-out for channel selection controls

Wireless receivers have several controls for channel selection but they do not need to be adjusted on a regular basis. The better receivers will lock out these controls so they cannot be accidentally changed. Settings will be adjusted initially by the installer and should not need altering unless interference problems arise.

The **Audio Amplifier** takes the signal from the receiver and amplifies it so that it can be used to power the loudspeakers. An amplifier typically has one or two volume controls. Two independent controls are required if there are both a teacher’s microphone and a students’ microphone.

Ideally, **an amplifier should have both a “Bass” and “Treble” control to make speech sound natural and clear.** Excessive bass, for example, is not a desirable tone quality. It will make the teacher’s voice sound boomy and unnatural. A bass control is very useful if this problem arises. Controlling high-pitched sounds is also important because they affect speech clarity. A treble control can be used to boost the high-frequency speech sounds that may be diminished in large rooms.

Most purpose-designed sound-field systems combine a receiver and amplifier into a single component. Sound-field systems assembled by contractors will typically use two separate components. Neither approach has significant advantages or disadvantages.

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Personal FM System Output

Students with a hearing impairment require a separate personal FM system. These personal systems are an essential educational tool that greatly improves speech clarity beyond what can be achieved with a hearing aid alone. Hearing aids provide an increase in sound volume but that does not mean the student has normal hearing. Hearing aids amplify all surrounding sounds in an environment. As a result, not only speech, but all background noises are amplified. In addition, as the distance from the teacher increases, it becomes more difficult for the student to distinguish between speech and background sounds. Personal FM systems are designed to overcome the negative effects of distance and background sounds by bringing the teacher's voice directly into the student's hearing aid.



A critical feature for all sound-field system receivers is a special output that enables connection of a personal FM system. This connection allows the teacher's microphone to be shared between the sound-field system and the personal FM system. Without this special output, the teacher would need to wear two microphones and two transmitters.

6 . Loudspeakers



The main function of the loudspeakers is to reproduce the teacher's voice accurately and to distribute the amplified sound evenly throughout the classroom. For the teacher's voice to sound natural, the loudspeakers must not exaggerate or diminish any speech sounds. In other words, the **loudspeakers must have a uniform response throughout the entire range of speech frequencies.** To provide even distribution in the classroom, the **loudspeakers must radiate sound uniformly over a wide coverage angle.** Many good quality commercial loudspeakers have the frequency response and coverage characteristics necessary for classroom amplification.

Look for . . .

- ✓ uniform frequency response
- ✓ wide coverage angle

Sound-field systems are not intended to be used like a public address system where voice levels are increased well above a natural level. The loudspeakers should only provide enough volume to ensure that all students hear the teacher's voice as loudly as the student sitting immediately in front of the teacher. When set up properly, students are only mildly aware that the system is operating.

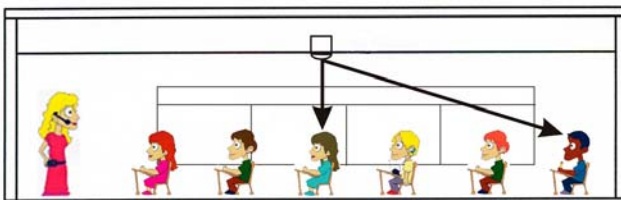
Sound-field systems are typically supplied with one, two or four loudspeakers. They can be mounted on the walls or the ceiling. In most classrooms, there is no optimum number of loudspeakers or ideal placement. However, the shape and size of a classroom and even the teaching style may influence the choice of loudspeaker configuration.

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In all classrooms, **the main objective is to keep a similar distance between all students and the loudspeakers**. This relationship is defined by the **Distance Ratio**, which compares the distance from the loudspeaker to the most distant student against the distance to the closest student. A Distance Ratio of approximately 2:1, or less, is good. Distance Ratios in excess of 3:1 should be avoided. Examples of different classroom designs and the appropriate loudspeaker configurations are described in the following sections.

Ceiling Mounted Loudspeakers

Ceiling mounted loudspeakers are an effective and economical choice for many schools. However, they require careful selection, especially for classrooms with low ceilings as found in many portables.

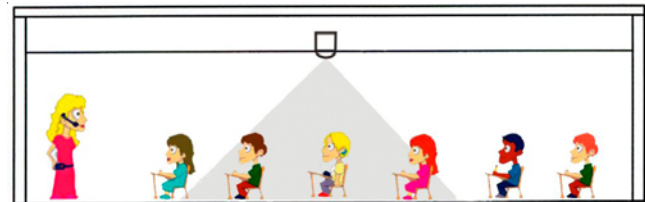


✘ Poor - Excessive Distance Ratio = 3.1:1

This example illustrates some potential problems. A single loudspeaker mounted near the centre of the room can result in an unacceptably large variation in sound level. Students sitting directly below the loudspeaker may hear the teacher's voice much louder than students at the far end of the classroom.

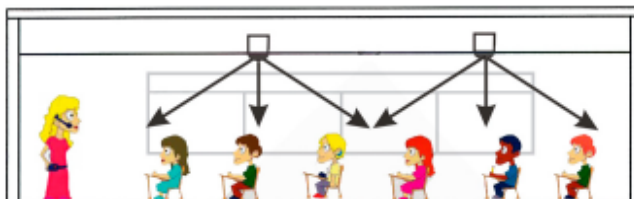
This problem can arise for two reasons. First, the disparity in the separation between students and the loudspeaker is excessive. In this example, the student at the back of the room is over three times as far from the loudspeaker as the student who is sitting directly below it.

Secondly, the loudspeaker does not radiate sound evenly in all directions. Inexpensive paging loudspeakers, for example, often beam sound directly below and further exaggerate the variation in sound level throughout the classroom.

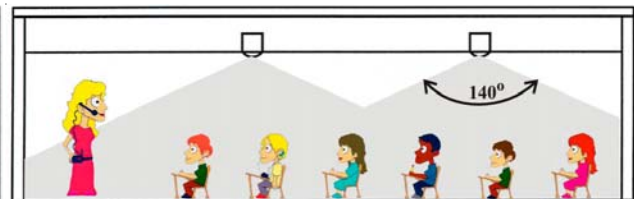


✘ Poor - Narrow Coverage Angle

A simple solution is to install more than one loudspeaker as shown in the example below. Now the student at the back of the room is not much further from the loudspeaker compared to the student sitting directly below it. Equally as important, **a good loudspeaker has a wide coverage pattern to avoid any focusing of sound**. A coverage angle of 140° or more is ideal.

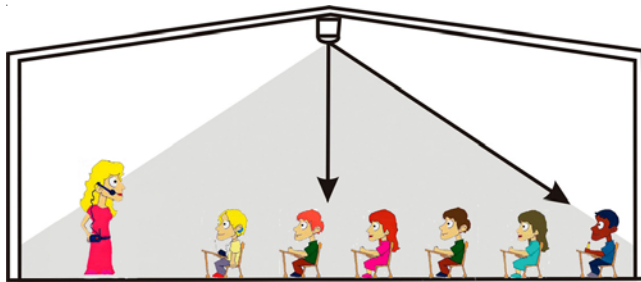


✓ Good - Distance Ratio = 1.7:1



✓ Good - Wide Coverage Angle

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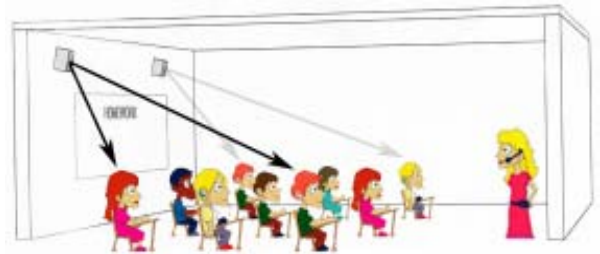
- ✓ Distance Ratio = 2:1
- ✓ Wide Coverage Angle

Higher ceilings diminish the need for additional loudspeakers. **Classrooms that have a ceiling height of approximately 3.0 metres or more will need only a single, wide-coverage ceiling loudspeaker to ensure uniform sound levels.** A good ceiling loudspeaker configuration ensures that all students in the room hear the teacher's voice equally well.

Wall-Mounted Loudspeakers

Mounting loudspeakers on the walls is another common technique. **The loudspeakers should be positioned at a height of approximately 2.4 to 2.8 metres above the floor and angled downward.** Lower mounting heights are not recommended because of the increased likelihood of creating feedback. The mounting brackets should allow the loudspeakers to be aimed in both the horizontal and vertical direction. Swivel ball-mount brackets are the most adjustable.

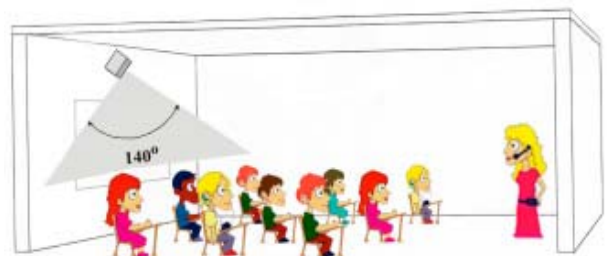
In many classrooms, two wall-mounted loudspeakers will provide acceptable sound coverage. The best wall for mounting loudspeakers is somewhat dependant on where the teacher is usually located. For example, if the teacher often stands at the front of the classroom, sound-coverage is especially uniform when the loudspeakers are mounted on the opposite wall facing the teacher. This placement works well because it compensates for the natural tendency of the teacher's unamplified voice to fall off toward the back of the room. The rear wall of the classroom is the preferred loudspeaker location under these circumstances.



- ✓ Distance Ratio = 2:1

Some contractors prefer to mount loudspeakers on the front wall, behind the teacher. With this placement the amplified sound is more natural because it emanates from the same general direction as the teacher. However, the sound coverage is less uniform especially in classrooms with low ceilings.

A single wall-mounted loudspeaker is sometimes used to reduce cost. Only products with an exceptionally wide coverage angle are suitable in this situation. An acceptable loudspeaker of this type should provide a horizontal coverage angle of 140° or more.



- ✓ Wide Coverage Angle

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Mounting all the loudspeakers on a single wall is less desirable if the teacher often changes the orientation of the students' desks or frequently moves about the classroom. Some teachers prefer to rearrange the desks to accommodate various activities - with the front of the classroom one day becoming the back of the classroom the next.

In these situations, **four wall-mounted loudspeakers will provide even sound distribution for all seating arrangements.** If the room has a rectangular floor plan, the loudspeakers should be mounted on the longer side walls so as to surround the entire seating area. Each speaker should be aimed to cover approximately one-quarter of the seating area. Four loudspeakers can also be very effective if the classroom has an irregular shape.

IV. CHOOSING THE RIGHT WIRELESS TECHNOLOGY

Two types of wireless systems are used in sound-field applications. The most common is wireless radio technology; referred to as radio frequency or **RF**. In this case, electromagnetic radio waves are used to transmit the signal. The other type of technology uses infrared light, **IR**, as the transmission mechanism. The choice between RF and IR technologies will depend on a number of considerations, primarily cost and the number of sound-field systems that are required to operate within the school.

1. RF Systems

RF sound-field products are further divided into three broad categories, **VHF (high band)**, **VHF (low band)** and **UHF**. The least expensive RF systems operate in a frequency range, known as the "high band", along with many other wireless products. Depending on the manufacturer, VHF (high band) is limited to a maximum of 16 to 24 channels, or classrooms, that can be used simultaneously within a school. This limit assumes that only a teacher's microphone is supplied in each classroom. If additional handheld microphones for students are required, only 8 to 12 classrooms can be accommodated within the school.

Sound-Field System Technology	Cost	Channels per School
RF		
VHF (High Band)	\$	16 – 24
VHF (Low Band)	\$\$	35 - 40
UHF	\$\$ - \$\$\$	35 – 80
IR	\$\$\$	Unlimited

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Another limitation of VHF (high band) is that other wireless systems operating on the same channel can be picked up from as far away as one kilometre. A neighbouring school, for example, using a similar sound-field system could easily cause interference. Due to these restrictions, **inexpensive VHF (high band) technology is most suitable for smaller and relatively isolated schools.**

More expensive UHF and VHF (low band) systems have much more channel capacity. Such technology usually is found in the purpose-designed sound-field systems. They allow schools to accommodate as many as 35 to 80 classrooms, depending on the manufacturer of the equipment. With that much capacity, there is little risk of any interference between classrooms. **Schools in urban areas should almost always opt for UHF or VHF (low band) systems.** Even if a school does not have to equip that many classrooms, the increased channel capacity provides flexibility to overcome interference from other systems should a nearby school or church, for example, install wireless microphones.

Another reason for providing excess channel capacity initially, is to allow for increasing the number of sound-field systems within the school at a later date. As more funding becomes available, it may be desirable to equip additional classrooms or add student microphones. **It is important to choose a system with sufficient capacity to meet current and anticipated needs.**

2. IR Systems

IR systems employ a completely different technology, which like a television remote control, uses infrared light to transmit the signal. Currently, most IR systems require the teacher to wear a device that resembles a small pendant. The pendant is actually a combination microphone and radiator from which the infrared signal is emitted. In addition, the teacher wears a bodypack unit that contains the batteries and associated electronics.



Some systems have combined the radiator into the bodypack. With these systems, a headset style microphone can be used.

Since light is used as the transmission mechanism, the signal is confined within each classroom. As soon as the teacher leaves the room, the system is deactivated. Conversely, a teacher or principal can enter any classroom and be instantly connected to the sound-field system. There is no need to have a unique transmitter and receiver for each classroom. **The number of IR systems that can be used in a school is therefore unlimited.** These attributes would make infrared the preferred technology, were it not for some significant disadvantages.



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Light transmission works best when there is a clear line of sight between the IR radiator and the receiver. In real classroom conditions, the line of sight is often diminished as the teacher moves about, holds a book in front of the radiator, or clothing covers the radiator. These circumstances will often cause the teacher's voice to drop off abruptly. To help overcome this problem, several auxiliary sensors must be strategically positioned throughout the classroom. Although this helps, the signal still will be interrupted occasionally.

Another drawback of many infrared systems is that the pendant worn by the teacher is essentially a lapel-style microphone with all the inherent disadvantages of that type of microphone.

It is expected that IR sound-field technology will make some advances in the future but the current generation of product displays some significant functional limitations. **Teachers in this study rated the performance of IR systems very low.** Currently infrared is also the most expensive of the three technologies.

V. INSTALLATION

Installation is normally included in the cost of a sound-field system. A qualified contractor will ensure that all materials, components and workmanship comply with the Alberta Building Code, Alberta Electrical Code as well as any specific requirements of the local school district.

Installation typically consists of the following steps:

- mounting the loudspeakers to the ceiling or walls.
- installing special plenum rated wire between the amplifier and loudspeakers
- covering any exposed wiring for protection
- adjusting all equipment settings to optimize performance
- training for appropriate teaching or administrative staff
- cleaning the worksite and repairing any damage to the walls and ceilings.

Due to the potential presence of hazardous materials, it is vital that the school district be informed of any installation work before it begins. Historically, asbestos fibres have been used in many building components, including mineral fibre ceiling tiles, drywall jointing compounds and sprayed-on fireproofing. Asbestos-containing materials are only a hazard if they are improperly disturbed. The presence or absence of asbestos fibres in these materials needs to be verified prior to beginning an installation. Appropriate procedures must be utilized when disturbing these materials and appropriate inspections may be required upon completion.

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Some schools have chosen to install sound-field systems using volunteer labour to reduce costs. **Do-it-yourself installation is strongly discouraged for safety and liability reasons.** It should never be attempted if hazardous materials are present.

VI. SERVICE AND WARRANTY

A good quality sound-field system should not require frequent maintenance or repair. However, these systems are used continually and some wear is inevitable. The components that break down most frequently are the microphones and transmitters because they are vulnerable to being accidentally damaged.

Availability of local service for repair or replacement is preferred. A component that needs to be sent out of the province for repair likely will result in significant down time and inconvenience. Most good quality products have Alberta-based suppliers.

Standard warranty periods of three years and longer are common. It is important to realize that warranties, in many cases, do not apply to every component. For example, many manufacturers will not cover the microphone, batteries or chargers for the full warranty period. Purchasing an extended warranty is generally not necessary, especially if a good quality system is provided initially.

VII. PURCHASE

The cost of a sound-field system varies from about \$1,000 to over \$2,400 per classroom. Systems at the lower end of the price range include the contractor-assembled systems that combine unique combinations of off-the-shelf components. The best of these systems will be very functional. However, they may lack many convenience features or the ability to expand the number of channels in the future. For some schools, these limitations are not very significant and the lower cost is a big advantage. Sound-field systems designed by manufacturers specifically for classroom use are priced in the middle to upper end of this range. For the increased cost, these systems offer the most features, durability and expansion capabilities.

Sound-field systems can be difficult to compare due to the numerous variations in features that are available. To assist with the purchase decision, many vendors are prepared to provide an in-school demonstration. This is a very useful approach that allows the purchaser an opportunity to ask questions and to more closely examine the equipment. The Checklist in the following section may be helpful in evaluating different products before a purchase decision is made.

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VIII. SOUND-FIELD SYSTEM CHECKLIST

Product Manufacturer: _____

Vendor: _____ **Cost:** _____

COMPONENT	YES	NO	COMMENTS
MICROPHONE:			
Headset Style			
➤ Comfortable, Adjustable			
➤ Unidirectional Pickup			
➤ "Front" of Microphone Clearly Marked			
➤ Replacement Windscreens			
➤ Boom Stays in Place			
➤ Cord Reinforcement Near Jack			
➤ Garment Clips on Mic Cord			
Lapel Style			
➤ Unidirectional Pickup			
➤ Replacement Windscreens			
Handheld - Student			
➤ Unidirectional Pickup			
➤ Designed for Small Hands			
➤ Anti-Roll Design			
➤ Audible Location Finder			
➤ Easy Battery Access			
➤ Durable Construction			
WIRELESS TRANSMITTER			
➤ Belt Clip Option - Secure Fit			
➤ Pouch Option - Form Fitting, All Controls Accessible			
➤ On/Off Switch - Easy Access			
➤ Mute Button-Convenient Operation			
➤ Batteries Easy to Remove			
➤ Battery Removal Not Required for Charging			
➤ 6-8 Hour Battery Life			
➤ "Low Battery" Indicator Light			
➤ Screw-On Microphone Connector or Microphone Cable Restraint			
➤ Lockout Feature for Set-up Controls			

SOUND-FIELD SYSTEMS GUIDE FOR CLASSROOMS

COMPONENT	YES	NO	COMMENTS
BATTERY/CHARGER:			
➤ NiMH (Nickel Metal Hydride)			
➤ Minimum 500 Recharge Cycles			
➤ Convenient Single Step Operation			
➤ "Smart Charger"			
WIRELESS RECEIVER/AUDIOAMPLIFIER			
➤ Output For Personnel FM System			
➤ Bass & Treble Controls			
➤ Separate Volume Controls for Teacher and Student Microphone			
LOUDSPEAKERS			
Ceiling Mounted Speaker			
➤ Uniform Frequency Response			
➤ Wide Coverage Angle (140° or more)			
Single Wall Mounted Speaker			
➤ Uniform Frequency Response			
➤ Wide Coverage Angle (140° or more)			
Two - Four Wall Mounted Speakers			
➤ Uniform Frequency Response			
➤ Swivel Ball-Mounting Bracket			
CHANNELCAPACITY			
➤ VHF (high band), 16-24 channels maximum			
➤ VHF (low band) or UHF, 35-80 channels Channel capacity varies with Manufacturer			
➤ IR - Unlimited Channel Capacity			
SERVICE & WARRANTY			
➤ Warranty of 3 Years or More			
➤ All Components Included in Warranty			
➤ Local Service for Repair/Replacement			