(i) In recent years many classrooms have been equipped with soundfield systems. The teacher wears a microphone close to the mouth and his or her voice is delivered via an amplifier and speakers mounted around the room. As a result the teacher need only use a normal speaking voice, reducing strain, and the system delivers an even spread, or “field”, of sound throughout the room. Normally a soundfield system is set up in such a way that the increase in volume is fairly modest – it is the even spread of sound which provides the benefit. However a soundfield system does not alleviate the difficult listening conditions created by high reverberation levels or excessive background noise. These issues should be addressed prior to soundfield systems being introduced by taking remedial action in accordance with DfES Building Bulletin 93 (BB93) The Acoustic Design of Schools or School Design: Optimising the Internal Environment, in Scotland.

If a deaf child has a personal FM system, this should always be used whether or not the classroom is soundfield equipped, since a personal FM system remains the most effective way of delivering a close-proximity voice to a hearing aid or cochlear implant wearer and delivers a better signal to noise ratio. “Classroom soundfield systems are not intended for children with moderate hearing losses or greater, for whom a personal FM system would ordinarily be more appropriate. The children will benefit more from a personal FM system than from a classroom system” (Ross, Levitt, 2002).

“Most deaf children who wear hearing aids or cochlear implants continue to need the superior S/N ratio provided by personal FM systems” (Crandell et al, 2004).

It would be cumbersome, and in some cases impractical, for the teacher to wear two microphone transmitters, and the way in which this can be avoided, if at all, depends on the type of soundfield system in use.

The wireless link from the microphone to the base unit (combined receiver and amplifier) will be one of the following four types:-

1. FM radio using narrowband VHF
2. FM radio using wideband VHF
3. FM radio using UHF
4. Infra-red

Narrowband VHF is employed in personal FM systems. If the soundfield system also uses this method, the child's personal FM receiver(s) should be set to the same frequency whenever the soundfield is in use. In this way the soundfield transmitter replaces the personal FM transmitter and delivers the teacher's voice directly to the hearing instrument as well as to the soundfield speakers. It is vital, however, that the personal FM transmitter MUST NOT be operating at the same time on the same frequency as the soundfield transmitter. If the child uses the personal transmitter when away from the soundfield-equipped classroom, it is a good idea to set the personal transmitter to a different frequency to avoid possible clashes, and to switch the receiver frequency to match.

If the soundfield uses one of the other three transmission methods (wideband VHF*, UHF or infra-red) then a technique known as “re-broadcasting” should be adopted, provided the design of the soundfield system permits it.
Generic principles for connecting a personal FM system to a soundfield system

- **Teacher with transmitter**
  - FM radio or infra red

- **Personal FM transmitter:** rebroadcasting soundfield system output

- **Soundfield receiver and amplifier; FM radio or infra red**
  - **Auxiliary input sockets**
    - (Possible aux inputs from: second microphone; computer; whiteboard; CD/DVD player; other classroom equipment)

- **Auxiliary output sockets**

- **Personal FM receiver**
  - Hearing aid or CI

- **Child hears all classroom audio inputs and teacher's voice**

Four or more loudspeakers
Most personal FM transmitters have the facility to directly inject an electrical signal to replace the normal input from the microphone. A typical use of this would be to deliver the sound of a TV/video programme directly from the auxiliary audio out socket(s) on the video/DVD player.

Many soundfield systems also have an auxiliary audio out socket and this same method can be employed to feed the audio content of the soundfield (whether it be live voice or recorded sound) to a personal FM transmitter, which would be placed near the base unit and connected via a suitable lead.

The method of connection depends on the type of personal transmitter, and the type of soundfield, in use. The most common type of output on soundfield base units is a pair of phono sockets as found on hi-fi separates and most video/DVD players. A lead with a pair of phono plugs at one end and a 3.5mm stereo jack plug at the other will provide a direct connection to three of the four common types of personal FM transmitter in current use – the Phonak Campus S, the Phonak Smartlink/Zoomlink/Easylink (with the bottom adaptor added) and the Connevans Genie. The Connevans 220 must have a transmitter input adaptor connected between the source and the socket on the side.

When a personal FM transmitter is transmitting an injected electrical signal, whether it be soundfield or video sound, it is preferable to mute its microphone in order to minimise noise. How this is achieved depends on the type of transmitter (the Connevans 220 mutes automatically when a plug is inserted in the side socket). It should also be noted that if the transmitter uses a “satellite” or lapel microphone, the microphone lead also serves as the transmitting aerial, so it must be left plugged in even though the microphone itself is muted.

**NB A wideband VHF transmitter has the capacity to cause interference to narrowband VHF receivers on nearby frequencies. For this reason, if a wideband VHF soundfield is in use the personal FM system should be set to a frequency as far removed as possible from that of the soundfield.**

Unfortunately, not all soundfield systems enable re-broadcasting as described. Some have no auxiliary output, while others have the base unit in an inaccessible place (in some cases above the ceiling with the speakers) In these circumstances, the wearing of two transmitters may be the only option. When considering the purchase of new equipment it is important to think about future potential use and optimum access for all. As it may be necessary to connect a personal FM transmitter to the soundfield receiver, the soundfield system selected should provide an easy means of connection. It is also desirable to have a means of adjusting the auxiliary output level and frequency response of the soundfield so that the set up for the personal FM system is not compromised.

Since there are an ever growing number of soundfield systems and personal FM systems available, it is important to approach the manufacturer of the personal FM system in the first instance and seek advice about connecting to the soundfield system. There is no uniform way to connect all systems and in practice there are sometimes management issues which compromise the listening experience of the deaf child (see examples on next page).
Common issues: There are a few simple precautions users should be aware of when connecting a personal FM system to a soundfield system:

- When schools connect external devices such as television or whiteboard to the soundfield, the lead used to connect these devices is often left connected to the soundfield but is disconnected from the external device. If the external input gain is not then set to minimum this can cause noise through the connected personal FM system.

- Most personal FM systems have an auxiliary input socket that is used to connect to the auxiliary output socket on the soundfield system. On some personal FM systems the microphone will still be switched on when connecting in this way. It is therefore important to mute the transmitter microphone to prevent unwanted background noise being transmitted.

Assessing the quality and level of the final re-broadcast sound to the deaf child is, at present, likely to be subjective. Where any incompatibility in use is experienced it is vital that this is addressed at the earliest opportunity with manufacturers or a technician familiar with the system.

These practical management issues underline the importance of ongoing training for all users and for additional technical support: www.ewing-foundation.org.uk

(ii) The following are illustrated examples of connecting specific personal FM systems to specific soundfield systems.
Phonak transmitter rebroadcast connections for Connevans classroom soundfield

**Campus S**

Lead pt no *A121B* will allow rebroadcasting of the overall soundfield sound via a Campus S for MLxS users.

The red & black phono plugs should be plugged into the soundfield output – sockets 5 & 6 (which way around does not actually matter!)

The 3.5mm plug connects into the Campus S ‘Audio’ socket. It is also necessary to mute the lapel microphone – see below – to avoid possible pick up of background noise or reverberent sound.

The rebroadcasted sound via the Campus S includes the sound from all active inputs – teacher, Multimedia, TV etc.

**SmartLink SX**

Pt.no. 45SIBPKFMG with 2.5mm plug connection lead and wall hook will allow rebroadcasting of the overall soundfield sound via a SmartLink SX for MLxS users.

The red phono plug should be plugged into the soundfield output – socket 6.

The 2.5mm plug connects into the SmartLink SX accessory interface mic socket. When connected this lead will automatically mute the SmartLink SX transmitter microphone when the soundfield is in use.

*Note: the SmartLink SX external microphone i/p is sound sensitive and will only be activated by sound input from the soundfield, once switched to external mic it will stay in that mode until reset.*

The rebroadcasted sound via the SmartLink SX includes the sound from all active inputs – teacher, Multimedia, TV etc.

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