Listen IR Divisible (Air) Wall Tech Note

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Using Listen IR Products in Divisible (Air) Wall Applications

Venues	Applications	Listen Product Types Used
• Hotel Ballrooms • Convention Space • Places of Worship • Other Venues	• Assistive Listening • Language Interpretation • Government handicap compliance (USA-ADA)	• Stationary IR • Digital IR

Overview

This tech note covers the technology required to design a wireless assistive listening and/or language interpretation system for multiple room divisible (air) wall rooms. In this application, the number and size of rooms changes on an as needed basis. Each new room must provide its own wireless listening/language interpretations system no matter what the configuration.

Example:
The ABC Convention Center has a configurable ballroom system that accommodates up to eight different rooms (see diagram 1). The rooms must be able to be divided into any of the possible configurations. For example, the room must be capable of eight separate rooms, one large room, two medium size rooms (A-D and E-H), etc.

A	E
B	F
C	G
D	H

Diagram 1. Example of an eight room air wall system. The ABC Convention Center requires that any combination of rooms be accommodated.

The core wireless transmission technology to be used is infrared (IR). Wireless FM (RF) technology is difficult to use in this application because of possible interference between the many channels in the area and because the listener would be required to change to the appropriate broadcast channel. A basic requirement this example above is that the listener only needs to turn the receiver on and adjust the volume.

IR offers the following advantages:

1. It is secure. This signal is kept within the room.
2. All users can use the exact same receiver without changing channels.
3. An infinite number of rooms can be employed.
4. The system can be used both for assistive listening and for language interpretation

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Designing an Air Wall System Using IR Technology

The first consideration in designing a system is to determine whether you are designing a single channel system or a multiple channel system. For single channel systems, there are two possible design methods and for multiple channel systems, only one of those methods is possible.

Method 1: Single Channel Air Wall System Using Auto-Seek (No RF Switcher)

This method uses Listen's Stationary IR product type. The auto-seek function of the LR-42/44 receivers is used to automatically search for a transmission channel in the room or area of a room where radiators are active. Four transmission channels are used. When a receiver is in auto-seek, it seeks for an active transmission channel on channels 1, 2, 3 and 4 and then stops on an active channel. When it loses the IR signal, it seeks for another signal on any one of the four channels.

Key Concept: It is important to understand that interference will occur if two different transmitter/radiator combinations are set to the same channel.

Radiators are placed in each room on transmission channels shown in diagram 2. When the air walls are closed all radiators are active and the auto-seek function of the receivers is used to find the channel in any given room. For example, let's say that one room is on channel 3 and another room is on channel 2. When a user steps into the first room, the receiver will find this channel and lock on to it. When the user goes to the next room, the receiver will unlock from channel 3 and lock on channel 2.

Once air walls are opened, the interior room radiators are turned off by not routing any audio to the corresponding transmitters. When this happens the radiators are deactivated after 30 minutes. The exterior room radiators are designed to radiate enough IR to cover the interior room space.

Summary

1. Radiators are placed in each room.
2. Radiators in exterior rooms are designed such that when the interior walls are open, they radiate sufficient IR into interior rooms.
3. When the air walls are open, the interior radiators must be turned off to prevent interference caused by two different transmission systems on the same channel. Radiators can be turned off (after 30 minutes) by not routing any audio to the corresponding transmitter.
4. Receivers are set to auto-seek. In this function, the receivers search for a transmission channel and then locks on to that channel. When the transmission is lost, the receiver unlocks and looks for another transmission channel.

Let's use an example to design a system for the ABC Convention Center. See diagram 2 and 3 for this discussion.

Refer to the diagram 2 that shows the air walls CLOSED. Rooms A and G are on channel 1, rooms B and H are on channel 2, so on and so forth. Each room has one to two radiators to cover the space. Rooms A, D, E and H have two radiators that are pointed to the interior space so that when the air walls are opened, they radiate enough IR to cover the interior rooms.

Now refer to diagram 3 showing the air walls OPEN. Notice that the radiators in rooms B, C, F and G are tuned off (**because no audio is being routed to their corresponding transmitter) and the radiators in rooms A, D, E and H fill the interior rooms.

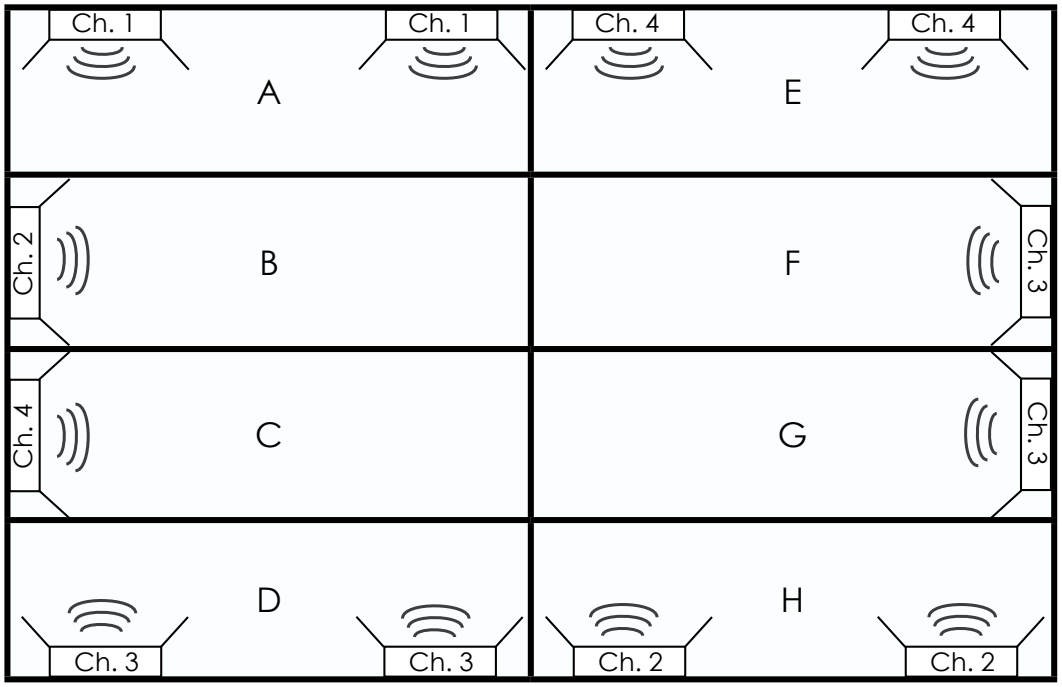

Diagram 2. Single channel air wall system using auto-seek, 8 room air wall system with all air walls CLOSED.

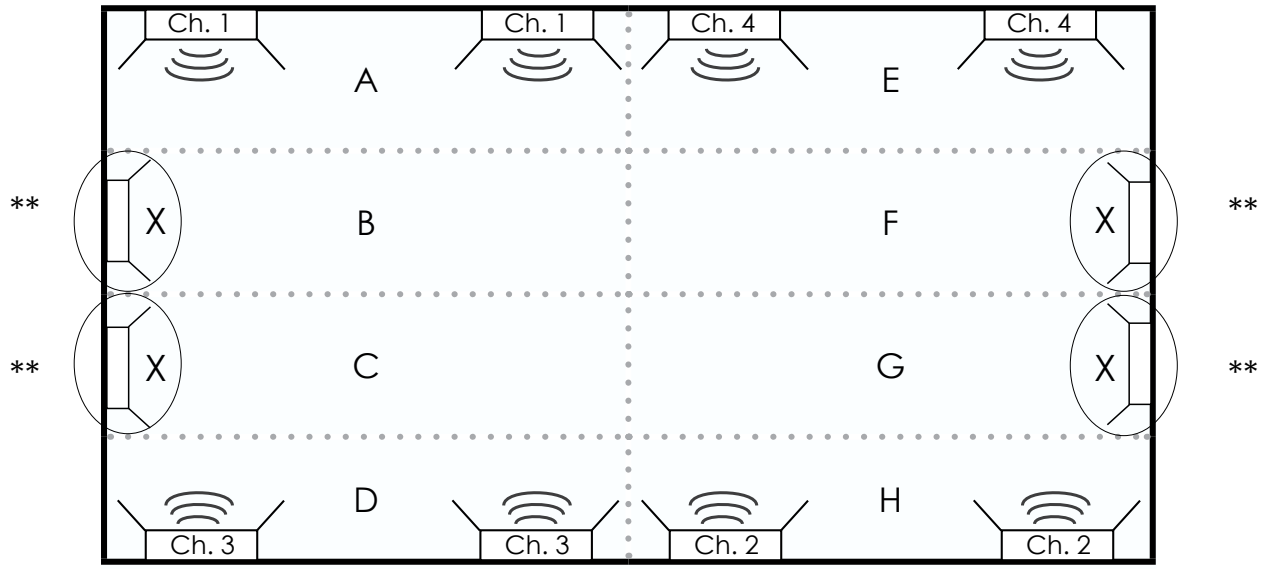

Diagram 3. Single channel air wall system using auto-seek, 8 room air wall system with all air walls OPEN.

** These radiators are deactivated. This accomplished by not routing audio to the corresponding transmitter. After 30 minutes, the radiators will be turned off.

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Method 2: Single Channel Air Wall System Using RF Switcher/Distribution Amplifier

There are four main blocks to designing such a system (see diagram 4):

- IR transmitter (modulator)
- IR radiator (emitter)
- Audio Matrix Mixer
- RF Switcher/Distribution Amplifier (it is possible for the audio matrix mixer and RF Switcher/Distribution Amplifier be the same device)

For each of these blocks, here are the specific products that Listen recommends you use:

- IR transmitter (modulator)
  - Listen LT-82
- IR radiator (emitter)
  - Listen LA-140
- Audio Matrix Mixer
  - No recommendation
- RF Switcher/Distribution Amplifier
  - Extron MAV Plus or similar

Diagram 4 shows how to implement the ABC Convention Center for ONE channel. In this case, you would specify a Listen LT-82 for the transmitter and an LA-140 for the radiators. Multiple channels for language interpretation are shown later in this document.

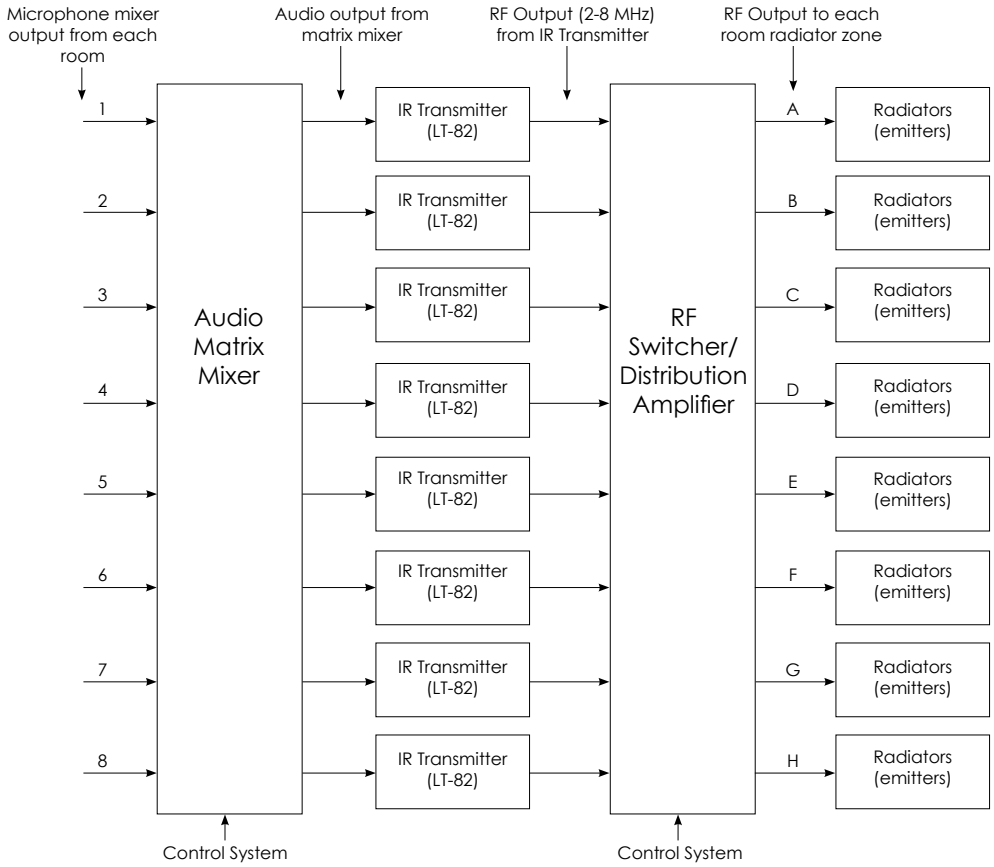

Diagram 4. Single channel air wall system using RF switcher/distribution amplifier

Here's how it works:

1. Each room has its own microphone mixer. This is usually accomplished with a DSP type matrix mixer. This output is delivered to the input of the audio matrix mixer. The matrix mixer most likely is also part of DSP matrix mixer. A control system (such as AMX or Crestron) controls which audio sources are delivered to the input of transmitters.

2. A single audio output is delivered to the input of each IR transmitter. The IR transmitter modules the signal and creates an RF signal on a frequency between 2 and 4MHz. This signal is delivered to the RF Switcher/Distribution Amplifier.

3. The RF Switcher/Distribution Amplifier is required because it has sufficient bandwidth to pass the RF signal. The RF Switcher/Distribution Amplifier routes RF carriers to the eight radiator zones (multiple radiators) and is controlled by a separate control system such as AMX or Crestron.

4. In this method, all transmitters and receivers are set to channel 1. Users of the system simply use the same receiver (without having to tune the channel) for any room configuration.

Example 1: Eight Separate Rooms. See diagram 5.

In this case, the control signal tells the audio matrix mixer to route each room mixer output (1-8) to the individual inputs of each transmitter (1-8). In addition, a control signal tells the RF Switcher/Distribution Amplifier to route the individual RF output of each transmitter (1-8) to the input of each individual radiator zone (A-H).

Example 2: All Rooms Combined. See diagram 6.

In this case, the control signal tells the matrix mixer to combine all eight audio mixers into one audio source. This audio source is delivered to output 1 and to transmitter 1 only. Transmitters 2-8 are not used. The control signal then tells the RF Switcher/Distribution Amplifier to take the RF input from transmitter 1 and distribute to the radiators in all zones (A-H).

Example 3: Four Rooms Combined. See diagram 7.

This example combines rooms A-B, C-D, E-F, and G-H. In this case, the control signal tells the audio matrix mixer to combine the outputs of the microphone mixers into four audio signals consisting of rooms A-B, C-D, E-F and G-H. These four outputs are delivered to the first four transmitters. The other four transmitters are not used in this example. The control signal tells the RF Switcher/Distribution Amplifier to take the RF output of transmitter one and send it to four radiator zones A-B, C-D, E-F and G-H.

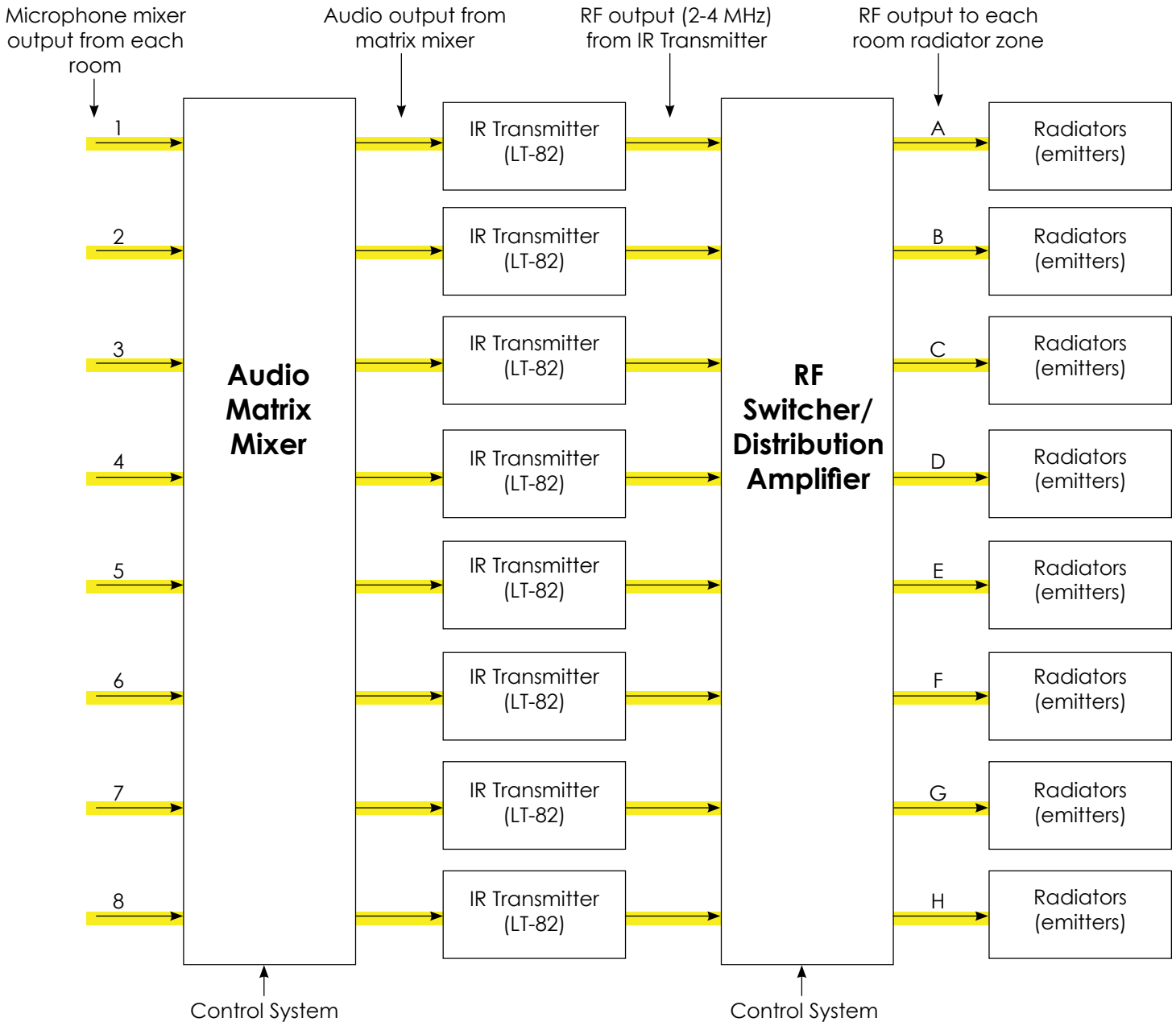

Diagram 5. Example showing all air walls CLOSED.

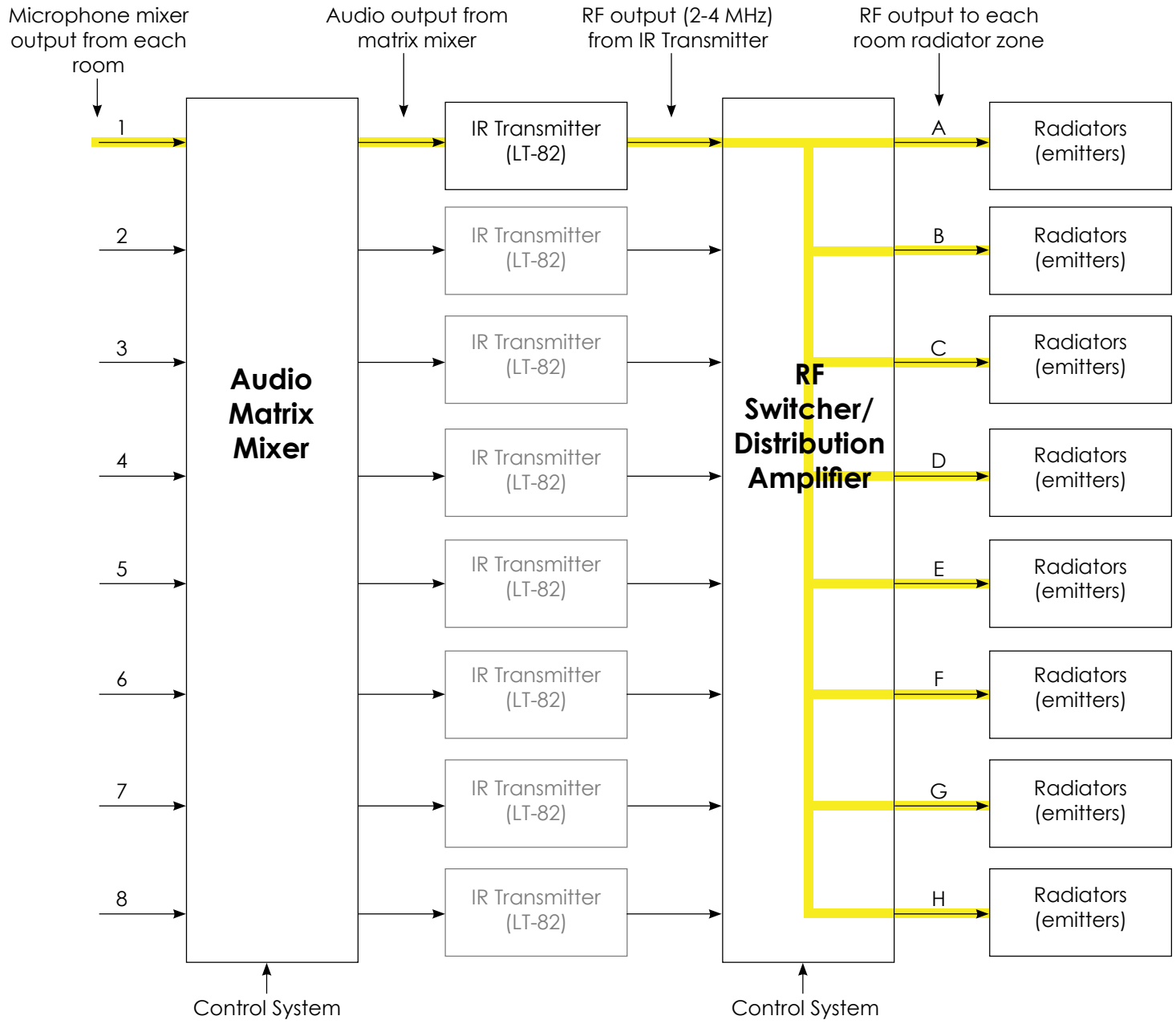

Diagram 6. Example showing all air walls OPEN.

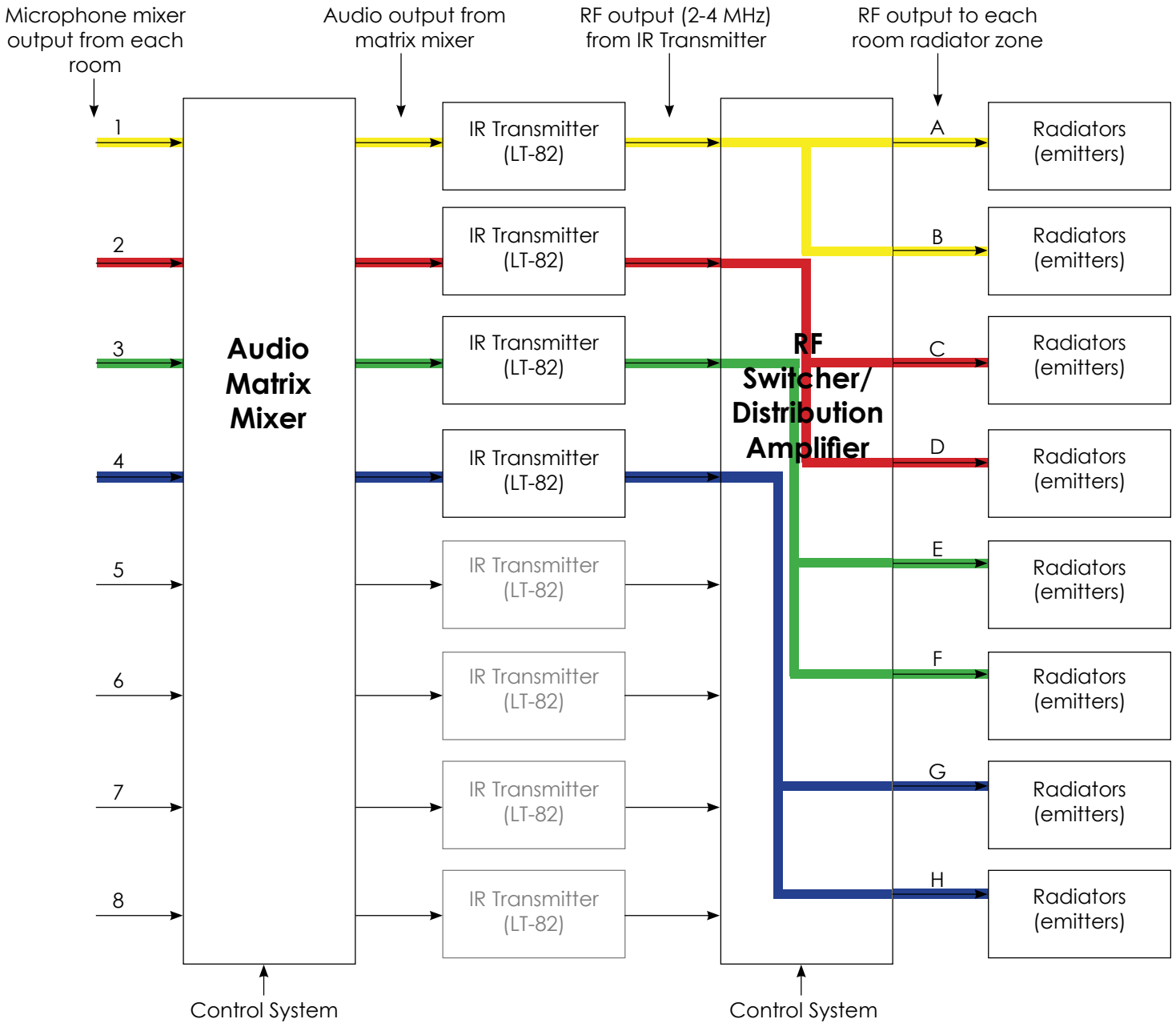

Diagram 7. Example showing rooms A-B, C-D, E-F and G-H combined.

Designing a multi-channel assistive listening and language interpretation system

It is probable that some or all of the rooms you are designing will require both assistive listening and language interpretation. The addition of language interpretation is straightforward and adds great value to the venue for end users that speak different languages.

The design of this system is similar to a single channel system except that multiple transmission channels are required for each interpreted language. For multiple channel systems, Listen recommends the following equipment:

- IR transmitter (modulator)
  - 1 to 4 Channels: Listen LT-82
  - 5 to 32 Channels: Listen INT-TX## (## = 04, 08, 16 or 32 channels) with additional interpretation equipment
- IR radiator (emitter)
  - 1 to 4 Channels: Listen LA-140
  - 5 to 32 Channels: Listen LBB 4511/00 (medium power) and/or LBB 4512/00 (high power)
- Audio Matrix Mixer
  - No recommendation
- RF Switcher/Distribution Amplifier
  - Exron MAV Plus or similar

Two diagrams are shown below (diagrams 8 and 9). One shows how to do a multiple channel system using Listen Stationary IR products and the other shows the same system using Listen Stationary IR and Digital IR products.

Multiple Channels System for Language Interpretation Using Listen Stationary IR Product Type:

In diagram 8 you can see that four LT-82 transmitters are daisy chained together to create a four channel language interpretation system. The output of the last one is routed to the RF switcher/distribution amplifier. This RF signal carries four IR channels in ONE RF signal. The RF switcher/distribution amplifier routes this signal to the appropriate room(s). For this example, the ABC Convention Center is using only one active interpretation system at any one time (although it may be routed to any combination of rooms). To use additional interpretation systems, add additional daisy chained transmitters to the system.

Multiple Channels System for Language Interpretation Using Listen Stationary IR Product Type and Digital IR Product Type:

Refer to diagram 9. The advantage of this system is that up to 32 channels of language interpretation can be implemented and the system uses interpreter desks. The diagram shows a six channel interpreter desk. For more than six channels refer to Listen Digital Conferencing product type. The disadvantage of this system that different receivers are used for single and multiple channel rooms. Users will need a digital IR receiver for language interpretation and stationary IR receiver for all other rooms.

The room audio is routed normally to the input of the digital IR transmitter via the audio matrix mixer. The interpreter desks supply the necessary audio routing to the transmitter for language interpretation.

The RF switcher/distribution amplifier routes and/or distributes the RF output (which contains 1 to 32 channels of audio) of the digital IR transmitter to any combination of rooms.

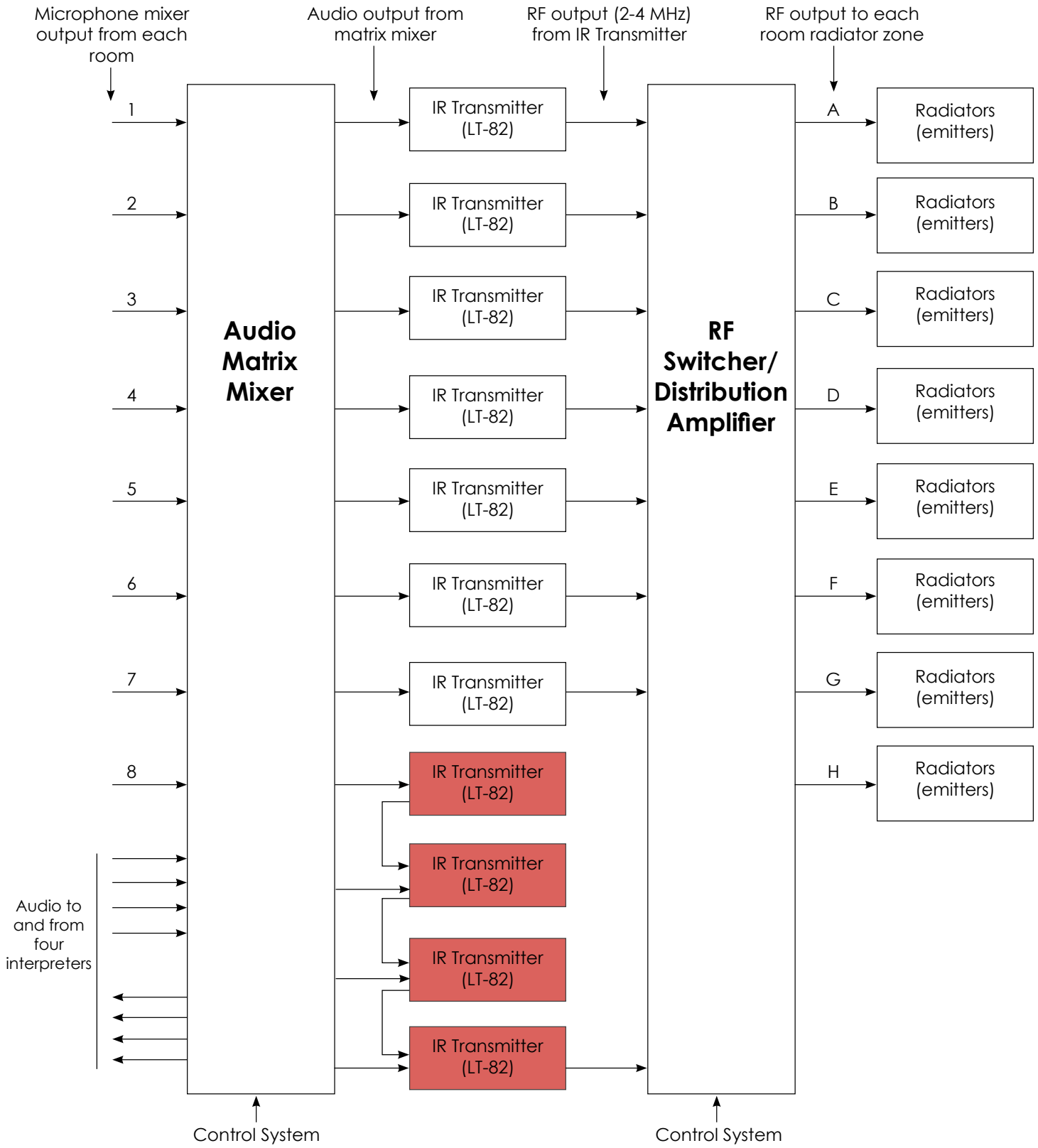

Diagram 8. Multiple channel system with four channels of language interpretation using Listen Stationary IR transmitters and receivers.

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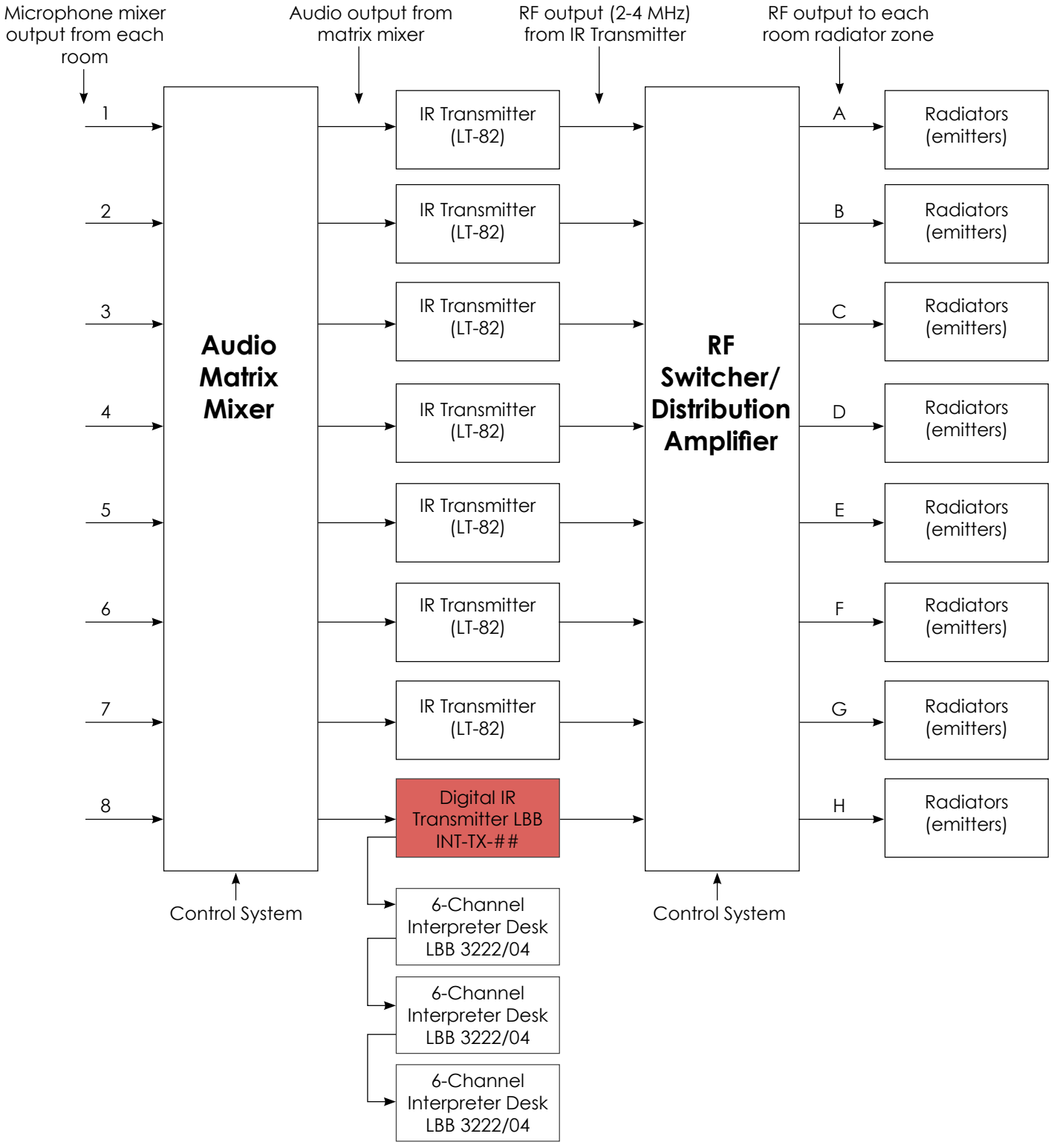

Diagram 9. Multiple channel system with 4 to 32 channels of language interpretation using Listen Stationary IR and Digital IR transmitters and receivers.

Design Considerations

When designing such rooms, you will need to keep the following in mind:

1. Delay. The coaxial cable used to route the RF signal from the transmitter to the RF switcher/distribution amplifier and to the radiators causes delay in the RF signal. This delay can causes the IR signals to add out of phase creating drop out zones in the rooms. Therefore, you will need to time align the entire system to ensure all radiators receive the RF signal at exactly the same time. All of the delay calculations must be determined by looking at the system as if it were one large room and all of the walls are removed.

    1a. For setting the delay on the Listen LA-140 radiators, Refer to the delay compensation instructions available in the Stationary IR System Design Guide. The Stationary IR Design Guide is available on the Listen website.

    1b. For setting the delay on the Digital IR radiators. Refer to the Integrus Delay Switch Calculation Tool available on the Listen website.

2. Radiator Coverage. It is important to ensure that the system be designed so that the radiators cover the space adequately. Keep in mind that as the number of channels doubles, the coverage halves. Thus, if you're doing a multiple channel system, you'll need much more radiators.

3. Let Listen help. Our product support staff is waiting and eager to help you design your system. See our web site for contact information in your area at ***www.listentech.com***.

Good luck and thanks for specifying Listen!