



Language Distribution System

Integrus



BOSCH

en Operation manual

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1 Safety

Prior to installing or operating the products, always read the installation instructions in section *Installation*, page 33 and the Safety Instructions which are provided with the mains powered products.

**Warning!**

To prevent possible hearing damage, do not listen at high volume levels for long periods.

2 About this manual

2.1 Purpose

The purpose of this document is to provide information required for installing, configuring, operating, maintaining and troubleshooting an Integrus Language Distribution System.

2.2 Intended audience

This document is intended for installers and users of an Integrus Language Distribution System.

2.3 Related documentation

- DCN Next Generation operation manual. Refer to the product related information at: www.boschsecurity.com

2.4 Alerts and notice signs

Four types of signs can be used in this manual. The type is closely related to the effect that may be caused if it is not observed. These signs - from least severe effect to most severe effect - are:



Notice!

Containing additional information. Usually, not observing a 'notice' does not result in damage to the equipment or personal injuries.



Caution!

The equipment or the property can be damaged, or persons can be lightly injured if the alert is not observed.



Warning!

The equipment or the property can be seriously damaged, or persons can be severely injured if the alert is not observed.



Danger!

Not observing the alert can lead to severe injuries or death.

2.5 Copyright and disclaimer

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2.6 Document history

Release date	Documentation version	Reason
2013.10.24	V1.3	New document layout.
2013.11.29	V1.4	EOL product information removed.

3 System Overview

3.1 System Overview

Integrus is a system for wireless distribution of audio signals via infrared radiation. It can be used in a simultaneous interpretation system for international conferences where multiple languages are used. To enable all participants to understand the discussion, interpreters simultaneously translate the speaker's language as required. These interpretations are distributed throughout the conference venue, and delegates select the language of their choice and listen to it through headphones. The Integrus system can also be used for music distribution (mono as well as stereo).

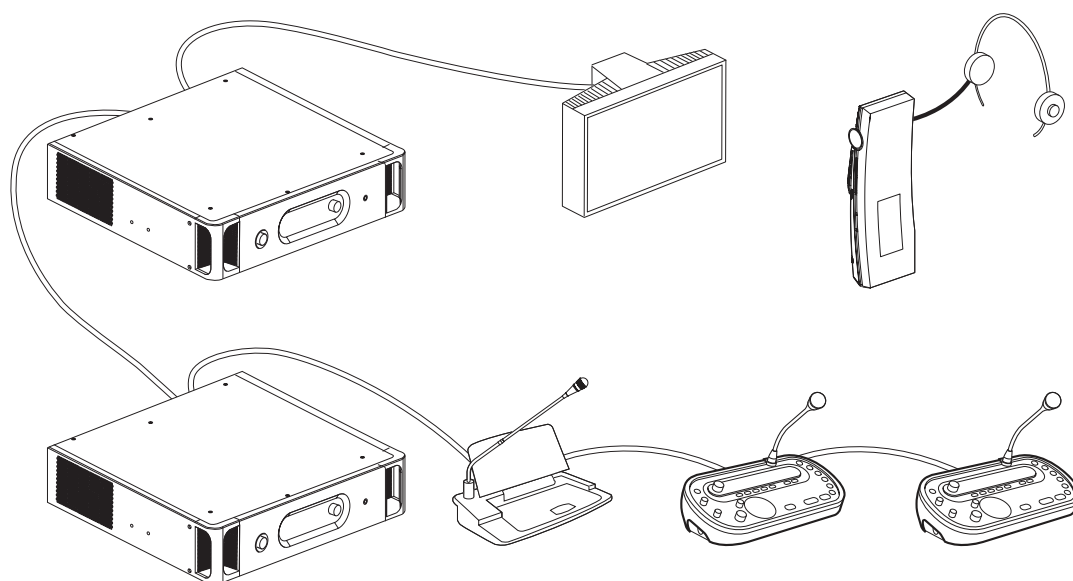


Figure 3.1: Integrus system overview (with DCN-system as input)

The Integrus Language Distribution System comprises one or more of the following:

Infrared transmitter

The transmitter is the core of the Integrus system. Four types are available:

- INT-TX04 with inputs for 4 audio channels
- INT-TX08 with inputs for 8 audio channels
- INT-TX16 with inputs for 16 audio channels
- INT-TX32 with inputs for 32 audio channels

The transmitter can be directly connected to the DCN Next Generation conference system (see section *Connection*, page 42).

Audio input and Interpreter module

The audio input and interpreter's module can be mounted in the transmitter housing to connect the transmitter to a wide range of conference systems:

- LBB 3422/20 Integrus audio input and interpreters module to connect to analogue discussion and conference systems (such as CCS 900) or to LBB 3222/04 6-channel interpreters desks.

Infrared radiators

Two radiators are available:

- LBB 4511/00 medium-power radiator for small/ medium conference venues
- LBB 4512/00 high-power radiator for medium/large conference venues

The radiators can be mounted on walls, ceilings or floor stands.

Infrared receivers

Three multi-channel infrared receivers are available:

- LBB 4540/04 for 4 audio channels
- LBB 4540/08 for 8 audio channels
- LBB 4540/32 for 32 audio channels

The receivers can operate with a rechargeable NiMH battery pack or with disposable batteries. Charging circuitry is incorporated in the receiver.

Charging equipment

Equipment is available for charging and storing 56 infrared receivers. Two versions are available:

- LBB 4560/00 charging suitcase for portable systems
- LBB 4560/50 charging cabinet for permanent systems

3.2 Integrus Transmitters

The transmitter is the central element of the Integrus system. It accepts asymmetrical audio sources from a maximum of 32 external channels (dependent on the transmitter type) and can be used with the DCN Next Generation conference system. It can also be used with analogue discussion and interpretation systems (e.g. CCS 900 with up to 12 interpreter desks), or as a stand-alone system distributing external audio sources.

Transmitter front view

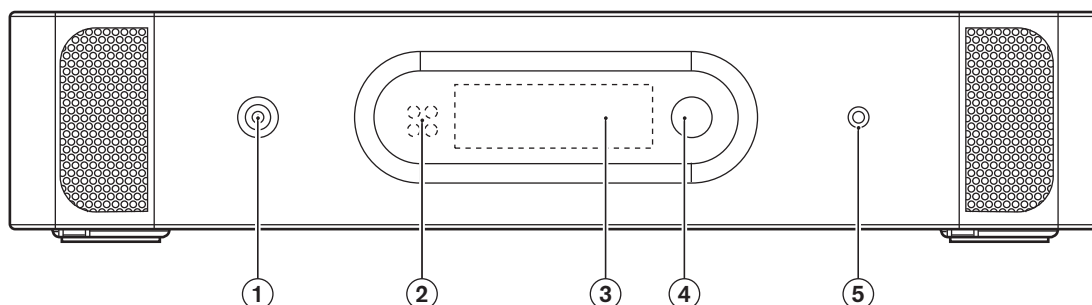
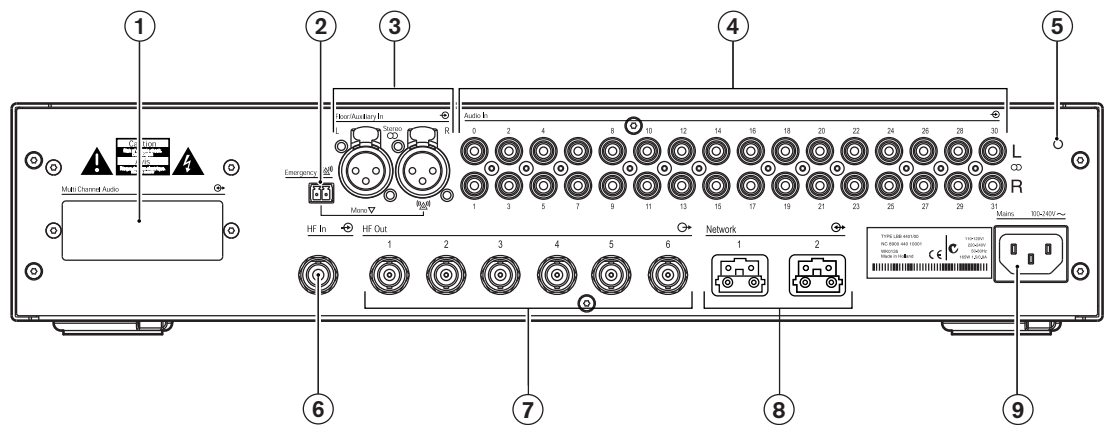


Figure 3.2: Transmitter, front view

1	Mains on/off switch - After switching the mains on, the transmitter starts up and the display (3) will light-up.
2	Mini IR-radiator - Four IREDs, transmitting the same infrared signal as the radiator output. This can be used for monitoring purposes. They can be disabled via the configuration menu.
3	Menu display - A 2x16 character LCD-display gives information about the transmitter status. It is also used as a an interactive display for configuring the system.
4	Menu button - A turn-and-push button to operate the configuration software in combination with the display (3)
5	Monitoring headphone output - A 3.5 mm (0.14 inch) jack socket to connect a headphone for monitoring purposes. It can be disabled via the configuration menu

Transmitter rear view**Figure 3.3: Transmitter, rear view**

1	Module slot - An optional audio interface module can be mounted in the transmitter housing. Its connectors are accessible via an opening at the back of the transmitter.
2	Emergency switch connector - A terminal block socket for a single, 'normally open' switch. When the switch is closed, the audio signal on the Aux-right input is distributed on all output channels, overriding all other audio inputs. A matching cable connector is provided.
3	Auxiliary audio inputs - Two female XLR connectors for extra audio inputs. They can be used to connect auxiliary symmetrical audio signals such as a music installation, the original floor language or emergency messages.
4	Audio signal inputs - 4, 8, 16 or 32 cinch plugs to connect external asymmetrical audio input signals. The number of connectors depends on the transmitter type.
5	Earth connection point - Only used for factory testing purposes.
6	Radiator signal loop-through input - A HF BNC connector to loop-through the radiator output of another transmitter.
7	Radiator signal outputs - Six HF BNC connectors, used to connect the radiators. Up to 30 radiators can be loop-through connected to each output.
8	Optical network connections - Two connections used to connect directly to the DCN Next Generation conference system with an optical network cable.
9	Mains input - Euro mains socket. The transmitter has automatic mains voltage selection. A mains cable is provided

The following sections give more information about the mentioned subject:

- Installation: *Integrus Transmitters*, page 33
- Connection: *Connection*, page 42
- Configuration: *Integrus transmitter*, page 48 and *Setup the transmitter*, page 51
- Operation: *Integrus transmitter*, page 69

3.3 Audio input and Interpreter module

The audio input and interpreter's module can be mounted in the transmitter housing to connect the transmitter to a wide range of conference systems:

- LBB 3422/20 Integrus audio input and interpreters module to connect to analogue discussion and conference systems (such as CCS 900) or to LBB 3222/04 6-channel interpreters desks. See the DCN NG operation manual for information of this product (on the DCN NG DVD or the product/DCN system related information section at: www.boschsecurity.com).
- This module must be mounted inside the transmitter housing (see section *Audio input and Interpreter module*, page 33).

3.4 Integrus Radiators

The radiators accept the carrier signals generated by the transmitter and emit infrared radiation carrying up to 32 audio distribution channels. They are connected to one or more of the six HF BNC outputs of the IR transmitter. A maximum of 30 radiators can be connected to each of these outputs by means of loop-through connections.

The LBB 4511/00 has an infrared output of 21 Wpp, while the LBB 4512/00 has an infrared output of 42 Wpp. Both have an automatic mains power voltage selection and are switched on automatically when the transmitter is switched on.

The attenuation of the signal by the cable is equalized automatically by the radiator. When the radiator is supplied with power and the transmitter is switched on, the radiator initializes the equalization. The red LED flash for a brief period of time to indicate that the initialization is in progress.

When not receiving carrier waves, the radiators switch to standby mode. There is also a temperature protection mode which automatically switches the radiators from full to half power or from half power to standby if the temperature of the IREDs becomes too high.

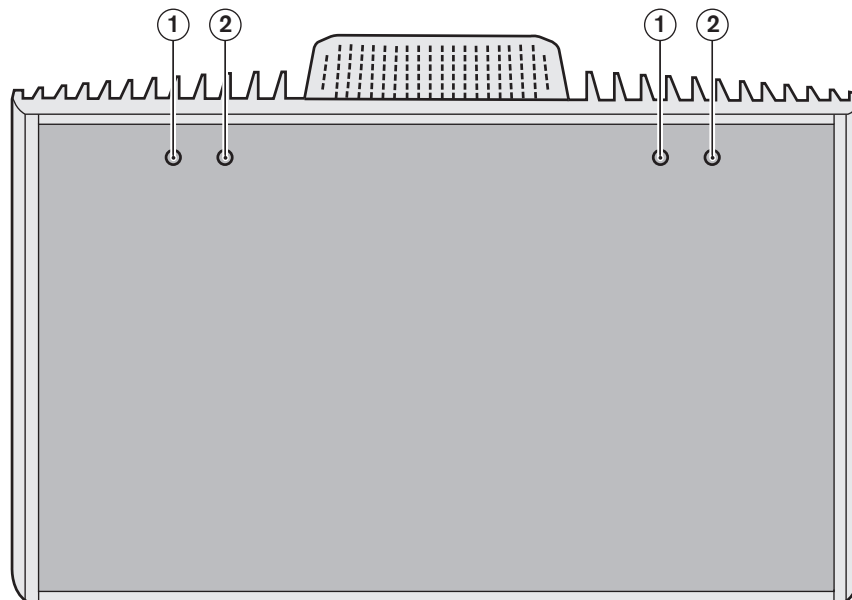


Figure 3.4: LBB 4512/00 High Power Radiator (Front view)

1	Red indicator LEDs - Give an indication of the radiator status, see section <i>Integrus Radiators</i> , page 69.
2	Amber indicator LEDs - Give an indication of the radiator status, see section <i>Integrus Radiators</i> , page 69.

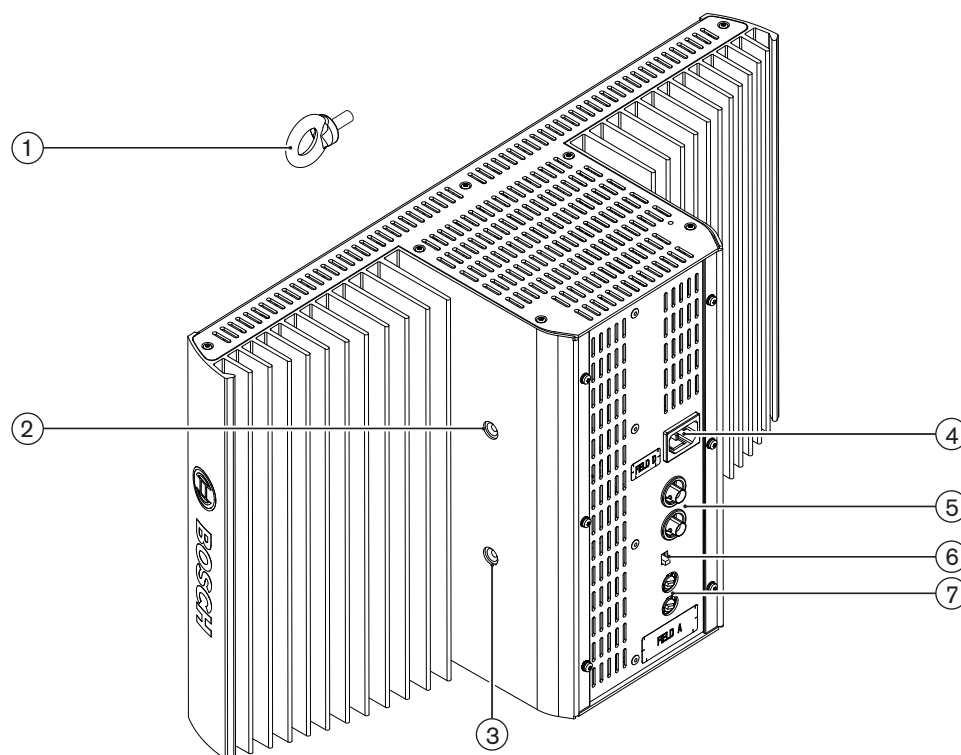


Figure 3.5: LBB 4512/00 Radiator (Side and rear view)

1	Safety eye - To mount a safety cord for extra security.
2	Safety eye hole - Tapped hole to mount the safety eye.
3	Bracket hole - Tapped hole to mount the suspension bracket.
4	Mains input - Male Euro mains connector. The radiators have automatic mains voltage selection.
5	IR signal input/loop-through - Two HF BNC connectors for connecting the radiator to the transmitter and for loop-through connection to other radiators. Automatic cable termination is achieved by a built-in switch in the BNC connectors.
6	Output power selection switch - The radiators can be switched between full- and half-power operation.
7	Delay compensation switches - Two 10-position switches to compensate for differences in cable lengths to the radiators.

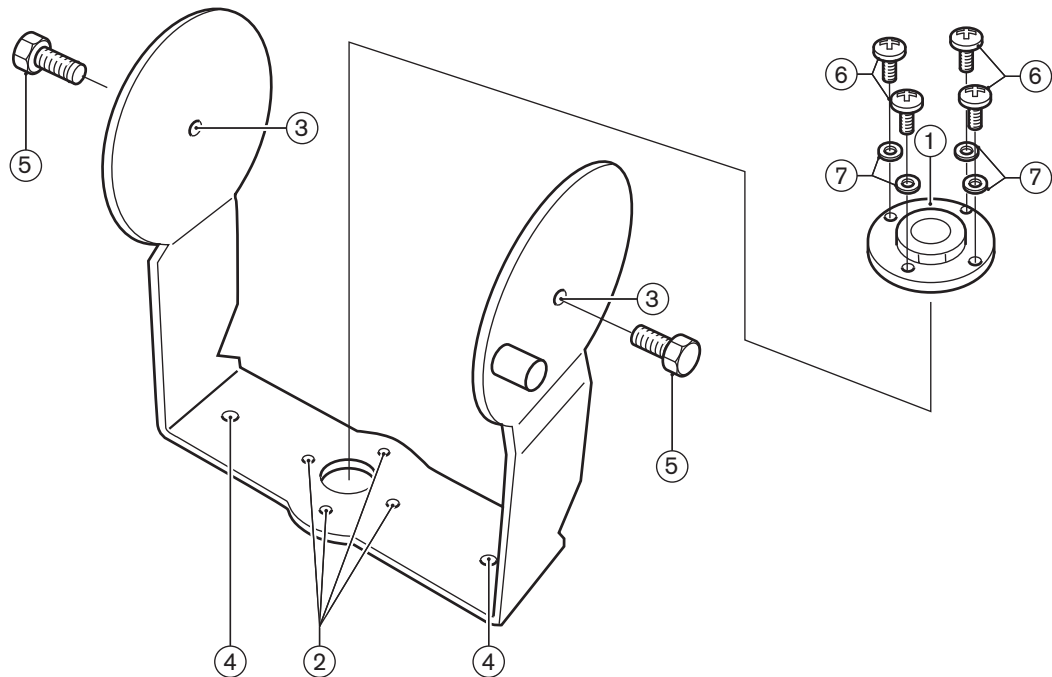


Figure 3.6: Suspension bracket and mounting plate of LBB 4511/00 and LBB 4512/00 Radiators

1	Mounting plate - Accessory plate to be used in case of mounting on a floor stand or wall mounting. Depending on the way of mounting, the mounting plate can be mounted at either one or the other side of the bracket (see section <i>Attach mounting plate to the suspension bracket</i> , page 36).
2	Mounting plate hole - Tapped holes to mount the mounting plate.
3	Radiator hole - Holes for bolts.
4	Mounting hole - Holes for screws to mount the bracket to the ceiling or on horizontal surfaces.
5	Bolt - Bolt to mount the suspension bracket to the radiator.
6	Screw - Screw to mount the mounting plate to the suspension bracket.
7	Washer

The following sections give more information about the mentioned subject:

- Installation: *Medium and High Power Radiators*, page 35
- Configuration: *Integrus Radiators*, page 59
- Operation: *Integrus Radiators*, page 69

3.5 Integrus Receivers

LBB 4540 receivers are available for 4, 8 or 32 channels. They can operate with a rechargeable NiMH battery pack or with disposable batteries and have controls for channel selection, volume adjustment and an on/off push button. All receivers have a 3.5 mm (0.14 inch) stereo jack output socket for mono or stereo headphones.

An LCD display shows the channel number and indicators for signal reception and low battery power.

Charging circuitry is included in the receiver.

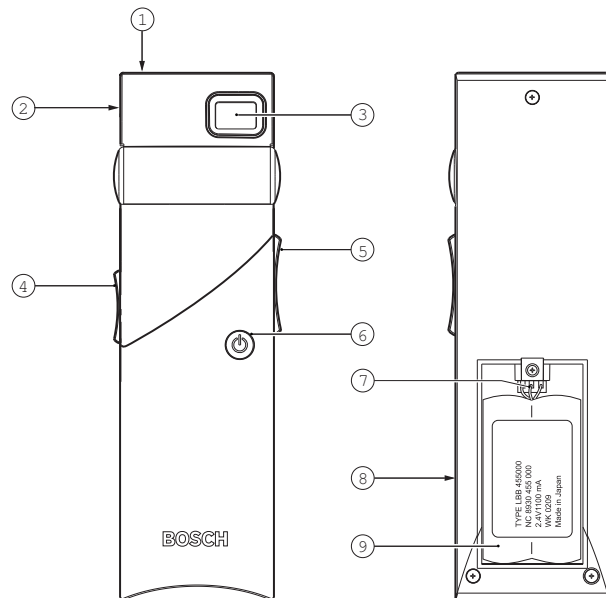


Figure 3.7: Receiver, front view and back view with open battery compartment

1	Charging indicator LED - Used in combination with the charging equipment.
2	Headphone connector - A 3.5 mm (0.14 inch) stereo jack output socket for the headphone, with integrated Stand-by/Off-switch.
3	LCD Display - A two digit display showing the selected channel. An antenna symbol is visible when the receiver picks up an infra red signal of adequate quality. A battery symbol is visible when the battery pack or the batteries are almost empty.
4	Volume control - A slider to adjust the volume.
5	Channel selector - An up/down switch to select an audio channel. The channel number is shown on the LCD display.
6	On/Off button - When a headphone is connected, the receiver switches to Stand-by state. Pressing the On/Off button switches the receiver from Stand-by to On. To switch back to Stand-by, press and hold the button for approx. 2 seconds. When the headphone is removed, the receiver switches automatically to the Off-state.
7	Battery pack connector - This connection is used to connect the battery pack to the receiver. Charging is automatically disabled when this connector is not used.

8	Charging contacts - Used in combination with the charging equipment to recharge the battery pack (if used)
9	Battery pack or disposable batteries - Either a rechargeable NiMH battery pack (LBB 4550/10) or two disposable A--size 1.5 V batteries.

The following sections give more information about the mentioned subject:

- Installation: *Integrus receivers*, page 40
- Operation: *Integrus Receivers*, page 70

3.6

Receiver Headphones

The headphones connect with the receivers via a 3.5 mm (0.14 inch) stereo jack connector.

Suitable headphone types are:

- LBB 3441/10 Under the chin stereo headphones
- LBB 3442/00 Single earphone (mono)
- LBB 3443/00 Stereo headphones
- HDP-ILN Induction Loop Neckband
- HDP-LWN Lightweight Neckband headphone
- Or any other compatible type (see *Technical Data*, page 77)

3.7 Integrus Charging Units

The charging units can recharge up to 56 receivers at once. The charging unit contains the power supply with automatic mains voltage selection. The charging electronics and a charging indicator LED are integrated in each receiver. The charging circuitry checks if a battery pack is present and controls the charging process.

Two versions are available, which are functionally identical:

- LBB 4560/00 Charging suitcase for portable systems.
- LBB 4560/50 Charging cabinet for permanent systems. Suitable for either table-top or wall-mounted use.

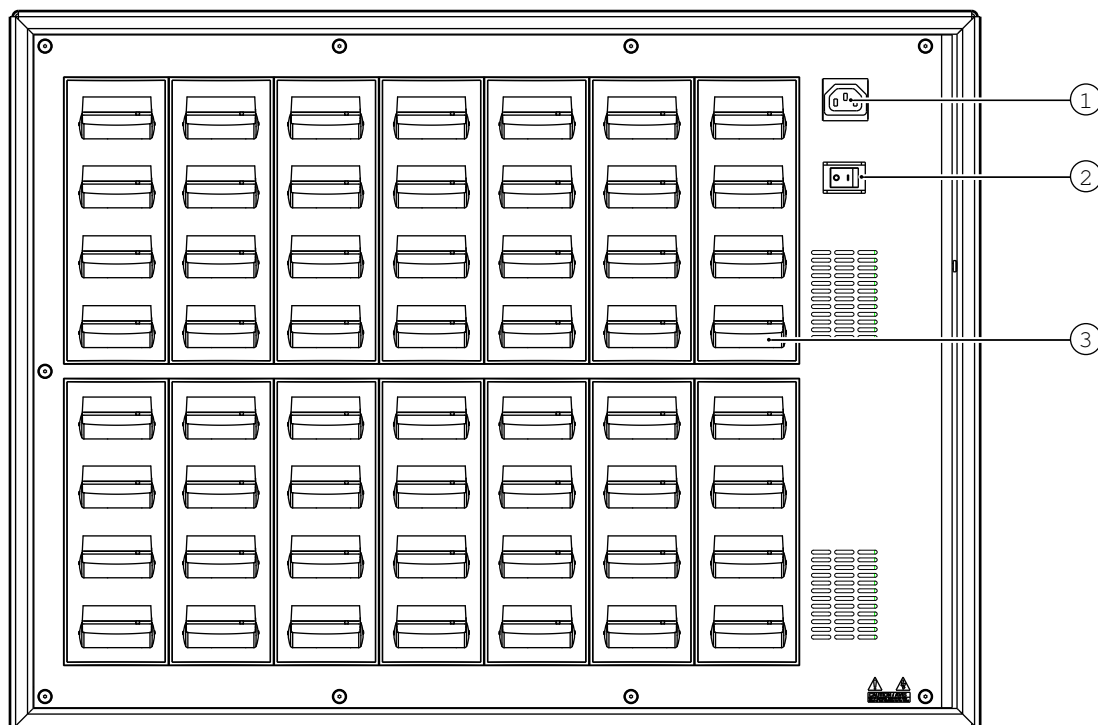


Figure 3.8: LBB 4560 Charging unit

1	Mains input - Male Euro mains socket. The charging unit has automatic mains voltage selection. A mains cable is provided.
2	Mains on/off switch
3	Receiver positions - One charging unit can charge up to 56 receivers simultaneously.

The following sections give more information about the mentioned subject:

- Installation: *Integrus Charging Units*, page 41
- Operation: *Integrus Charging Units*, page 71

4 Planning

4.1 System technology

4.1.1 IR radiation

The Integrus system is based on transmission by modulated infrared radiation. Infrared radiation forms part of the electromagnetic spectrum, which is composed of visible light, radio waves and other types of radiation. It has a wavelength just above that of visible light. Like visible light, it is reflected from hard surfaces, yet passes through translucent materials such as glass. The infrared radiation spectrum in relation to other relevant spectra is shown in the next figure.

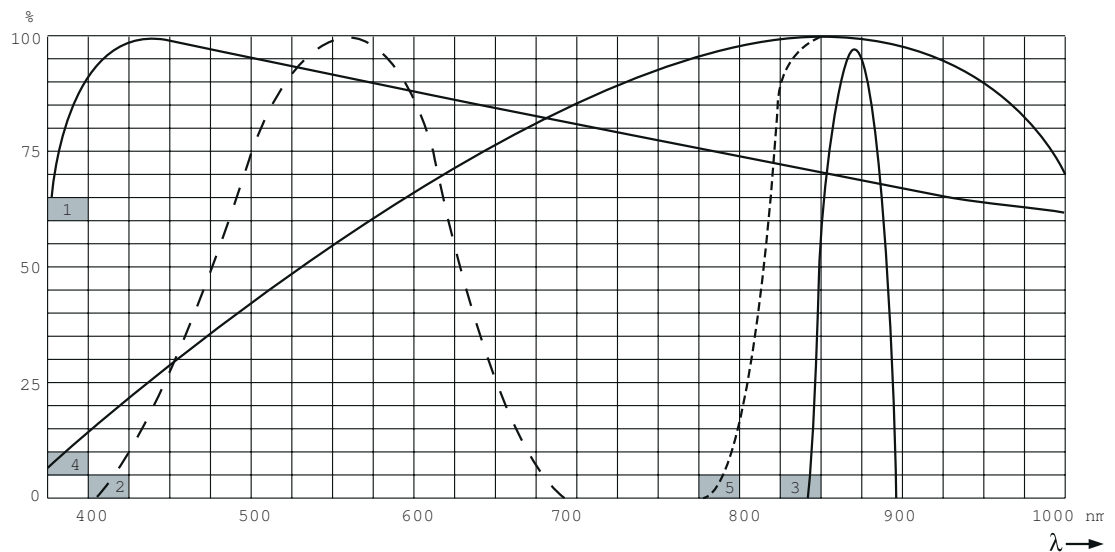


Figure 4.1: Infrared radiation spectrum in relation to other spectra

1	Daylight spectrum
2	Sensitivity of the human eye
3	IR radiator
4	Sensitivity of IR sensor
5	Sensitivity of IR sensor with daylight filter

4.1.2

Signal Processing

The Integrus system uses high frequency carrier signals (typically 2-8 MHz) to prevent interference problems with modern light sources (see section *The footprint of the radiator*, page 23). The digital audio processing guarantees a constant high audio quality.

The signal processing in the transmitter consists of the following main steps (see the next figure):

1. **A/D conversion** - Each analogue audio channel is converted to a digital signal.
2. **Compression** - The digital signals are compressed to increase the amount of information that can be distributed on each carrier. The compression factor is also related to the required audio quality.
3. **Protocol Creation** - Groups of up to four digital signals are combined into a digital information stream. Extra fault algorithm information is added. This information is used by the receivers for fault detection and correction.
4. **Modulation** - A high frequency carrier signal is phase-modulated with the digital information stream.
5. **Radiation** - Up to 8 modulated carrier signals are combined and sent to the IR radiators, which convert the carrier signals to modulated infrared light.

In the IR receivers a reverse processing is used to convert the modulated infrared light to separate analogue audio channels.

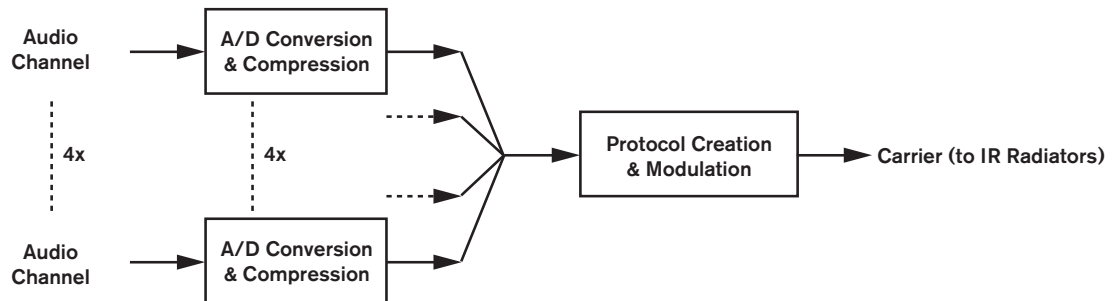


Figure 4.2: Overview of the signal processing (for one carrier)

4.1.3

Quality modes

The Integrus system can transmit audio in four different quality modes:

- Mono, standard quality, maximum 32 channels
- Mono, premium quality, maximum 16 channels
- Stereo, standard quality, maximum 16 channels
- Stereo, premium quality, maximum 8 channels

The standard quality mode uses less bandwidth and can be used for transmitting speech. For music the premium quality mode gives near CD quality.

4.1.4

Carriers and channels

The Integrus system can transmit up to 8 different carrier signals (depending on the transmitter type). Each carrier can contain up to 4 different audio channels. The maximum number of channels per carrier is dependent on the selected quality modes. Stereo signals use twice as much bandwidth as a mono signals; premium quality uses twice as much bandwidth as standard quality.

Per carrier a mix of channels with different quality modes is possible, as long as the total available bandwidth is not exceeded. The table below lists all possible channel combinations per carrier:

	Channel quality				Bandwidth
	Mono Standard	Mono Premium	Stereo Standard	Stereo Premium	
Possible number of channels per carrier	4				4 x 10 kHz
	2	1			2 x 10 kHz and 1 x 20 kHz
	2		1		2 x 10 kHz and 1 x 10 kHz (left) and 1 x 10 kHz (right)
		1	1		1 x 20 kHz and 1 x 10 kHz (left) and 1 x 10 kHz (right)
			2		2 x 10 kHz (left) and 2 x 10 kHz (right)
		2			2 x 20 kHz
				1	1 x 20 kHz (left) and 1 x 20 kHz (right)

4.2 Aspects of Infrared distribution systems

A good infrared distribution system ensures that all delegates in a conference venue receive the distributed signals without disturbance. This is achieved by using enough radiators, placed at well planned positions, so that the conference venue is covered with uniform IR-radiation of adequate strength. There are several aspects that influence the uniformity and quality of the infrared signal, which must be considered when planning an infrared radiation distribution system. These are discussed in the next sections.

4.2.1 Directional sensitivity of the receiver

The sensitivity of a receiver is at its best when it is aimed directly towards a radiator. The axis of maximum sensitivity is tilted upwards at an angle of 45 degrees (see the next figure). Rotating the receiver will decrease the sensitivity. For rotations of less than +/- 45 degrees this effect is not large, but for larger rotations the sensitivity will decrease rapidly.

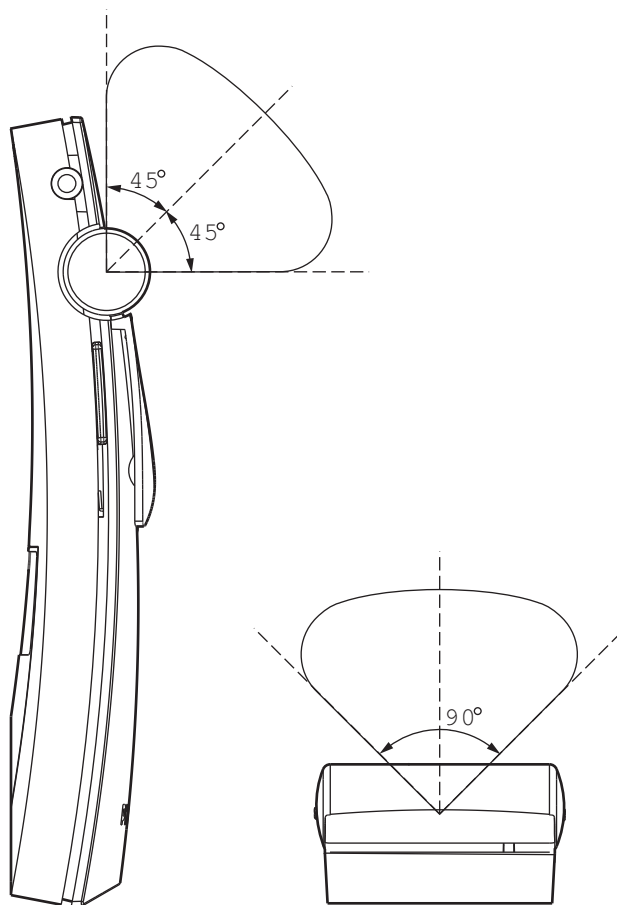


Figure 4.3: Directional characteristics of the receivers

4.2.2 The footprint of the radiator

The coverage area of a radiator depends on the number of transmitted carriers and the output power of the radiator. The coverage area of the LBB 4512/00 radiator is twice as large as the coverage area of the LBB 4511/00. The coverage area can also be doubled by mounting two radiators side by side. The total radiation energy of a radiator is distributed over the transmitted carriers. When more carriers are used, the coverage area gets proportionally smaller. The receiver requires a strength of the IR signal of 4 mW/m² per carrier to work

without errors (resulting in a 80 dB S/N ratio for the audio channels). The effect of the number of carriers on the coverage area can be seen in the next two figures. The radiation pattern is the area within which the radiation intensity is at least the minimum required signal strength.

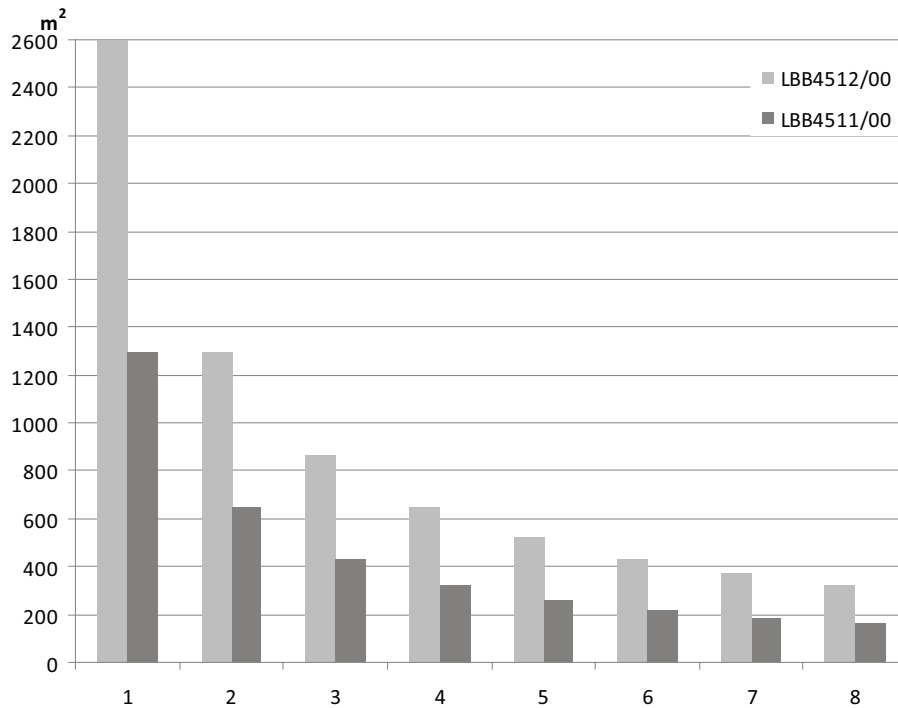


Figure 4.4: Total coverage area of LBB 4511/00 and LBB 4512/00 for 1 to 8 carriers

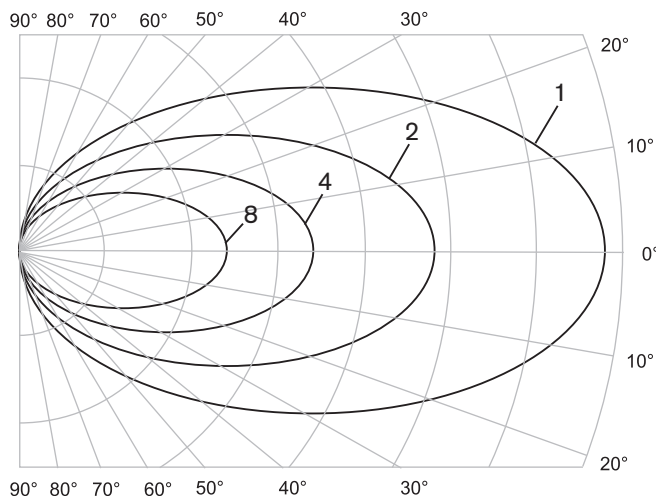


Figure 4.5: Polar diagram of the radiation pattern for 1, 2, 4 and 8 carriers

Footprint

The cross section of the 3-dimensional radiation pattern with the floor of the conference venue is known as the footprint (the white area in the following three figures). This is the floor area in which the direct signal is strong enough to ensure proper reception, when the receiver is directed towards the radiator. As shown, the size and position of the footprint depends on the mounting height and angle of the radiator.

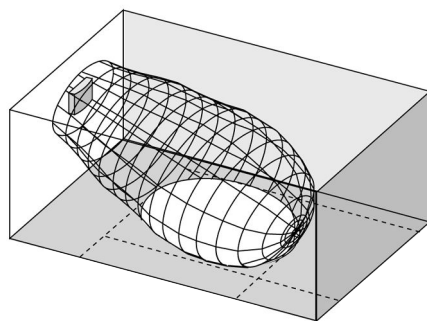


Figure 4.6: The radiator mounted at 15° to the ceiling

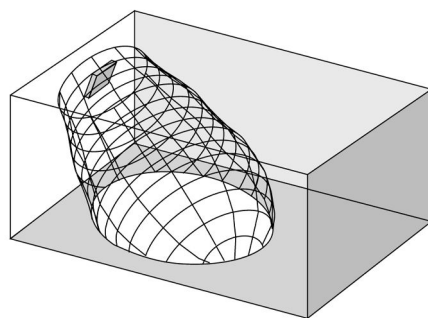


Figure 4.7: The radiator mounted at 45° to the ceiling

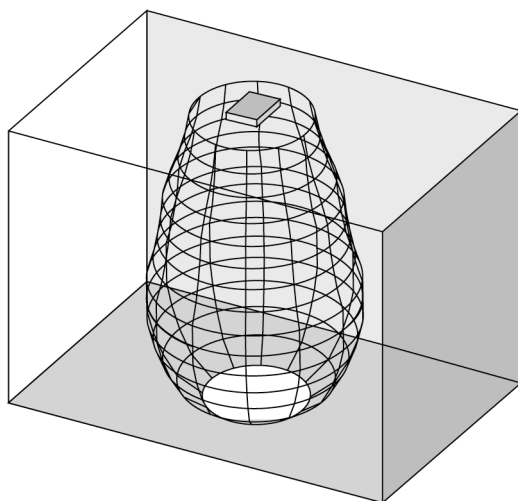


Figure 4.8: The radiator mounted perpendicular (at 90°) to the ceiling

4.2.3

Ambient lighting

The Integrus system is practically immune for the effect of ambient lighting. Fluorescent lamps (with or without electronic ballast or dimming facility), such as TL lamps or energy saving lamps give no problems with the Integrus system. Also sunlight and artificial lighting with

incandescent or halogen lamps up to 1000 lux give no problems with the Integrus system. When high levels of artificial lighting with incandescent or halogen lamps, such as spotlights or stage lighting are applied, you should directly point a radiator at the receivers in order to ensure reliable transmission. For venues containing large, unscreened windows, you must plan on using additional radiators. For events taking place in the open air a site test will be required in order to determine the required amount of radiators. With sufficient radiators installed, the receivers will work without errors, even in bright sunlight.

4.2.4

Objects, surfaces and reflections

The presence of objects in a conference venue can influence the distribution of infrared light. The texture and color of the objects, walls and ceilings also plays an important role. Infrared radiation is reflected from almost all surfaces. As is the case with visible light, smooth, bright or shiny surfaces reflect well. Dark or rough surfaces absorb large proportions of the infrared signal (see the next figure). With few exceptions it cannot pass through materials that are opaque to visible light.

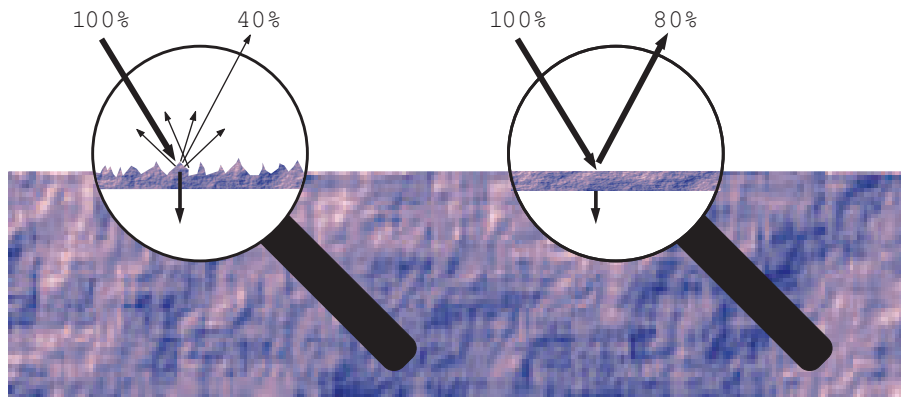


Figure 4.9: The texture of the material determines how much light is reflected and how much is absorbed

Problems caused by shadows from walls or furniture can be solved by ensuring that there are sufficient radiators and that they are well positioned, so that a strong enough infrared field is produced over the whole conference area. Care should be taken not to direct radiators towards uncovered windows, as most of this radiation will subsequently be lost.

4.2.5

Position the radiators

Since infrared radiation can reach a receiver directly and/or via diffused reflections, it is important to take this into account when considering the positioning of the radiators. Though it is best if receivers pick up direct path infrared radiation, reflections improve the signal reception and should therefore not be minimized. Radiators should be positioned high enough not to be blocked by people in the hall (see the next two figures).



Figure 4.10: Infrared signal blocked by a person in front of the participant

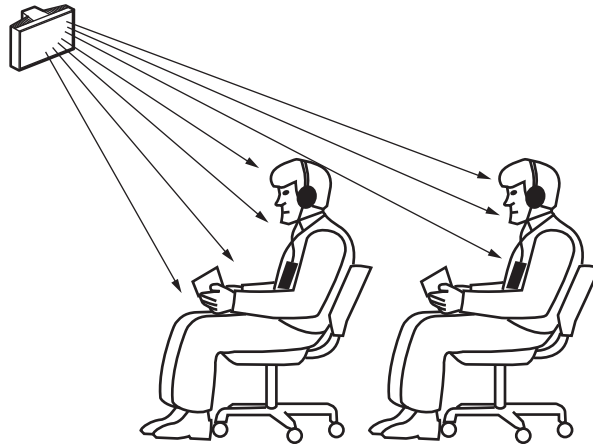


Figure 4.11: Infrared signal not blocked by a person in front of the participant

The figures below illustrate how infrared radiation can be directed to conference participants. In figure 4.12, the participant is situated clear from obstacles and walls, so a combination of direct and diffused radiation can be received. Figure 4.13 shows the signal being reflected from a number of surfaces to the participant.

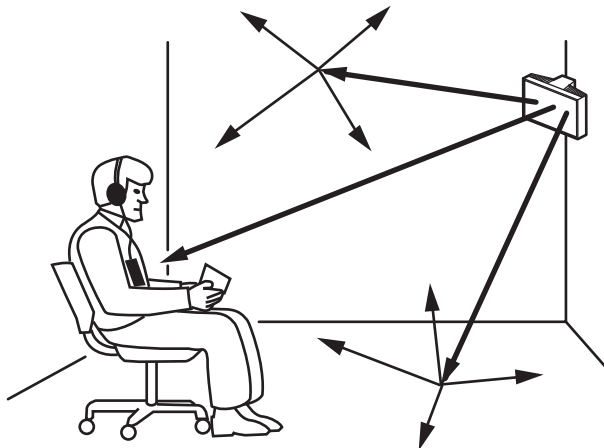


Figure 4.12: Combination of direct and reflected radiation

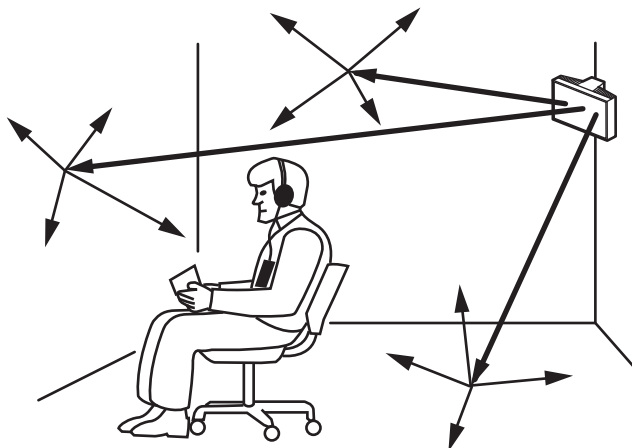


Figure 4.13: Combination of several reflected signals

For concentrically arranged conference rooms, centrally placed, angled radiators located high up can cover the area very efficiently. In rooms with few or no reflecting surfaces, such as a darkened film-projection room, the audience should be covered by direct path infrared

radiation from radiators positioned in front. When the direction of the receiver changes, e.g. with varying seat arrangements, mount the radiators in the corners of the room (see the next figure).

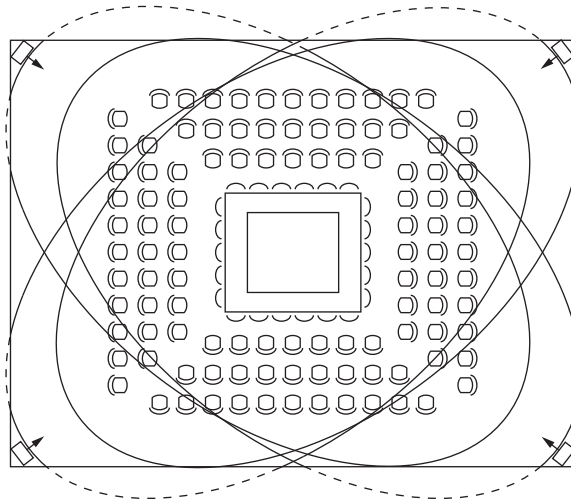


Figure 4.14: Radiator position for covering seats in a square arrangement

If the audience is always directed towards the radiators, you do not need radiators at the back (see the next figure).

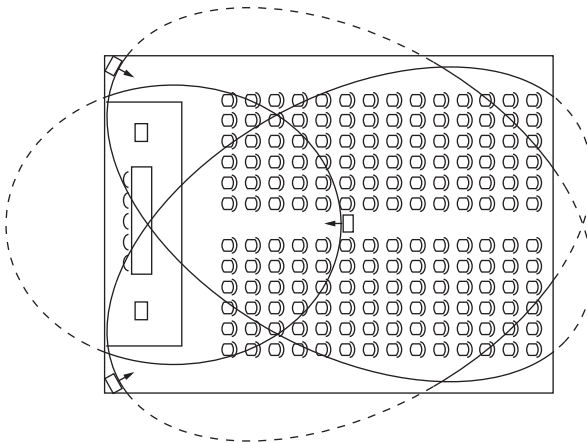


Figure 4.15: Radiator positioning in a conference hall with auditorium seating and podium

If the path of the infrared signals is partially blocked, e.g. under balconies, you should cover the 'shaded' area with an additional radiator (see the next figure).

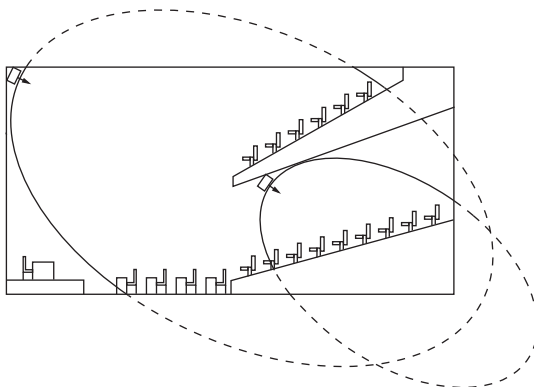


Figure 4.16: Radiator for covering seats beneath a balcony

4.2.6

Overlapping footprints and black spots

When the footprints of two radiators partly overlap, the total coverage area can be larger than the sum of the two separate footprints. In the overlap area the signal radiation power of two radiators are added, which increases the area where the radiation intensity is larger than the required intensity. However, differences in the delays of the signals picked up by the receiver from two or more radiators can result in that the signals cancel each other out (multi path effect). In worst-case situations this can lead to a loss of reception at such positions (black spots).

The next two figures illustrate the effect of overlapping footprints and differences in signal delays.

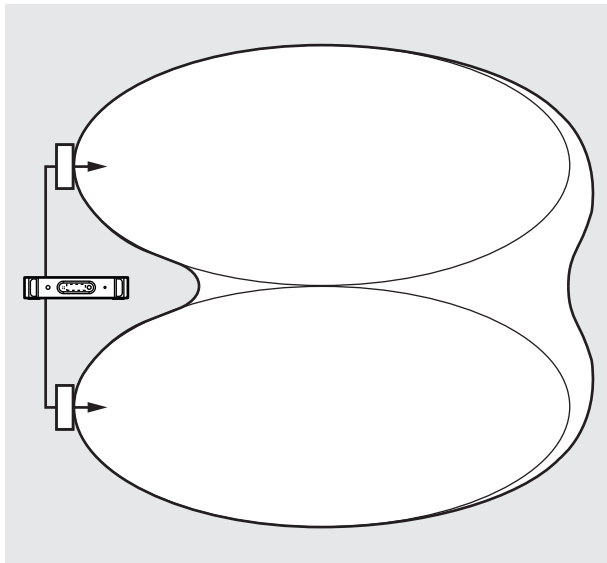


Figure 4.17: Increased coverage area caused by added radiation power

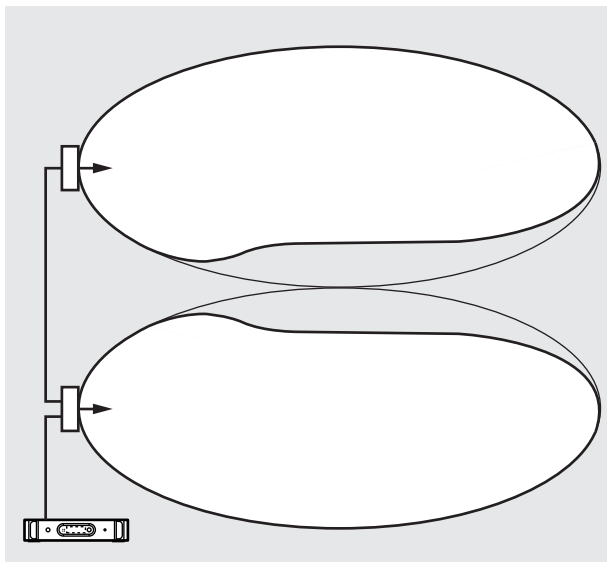


Figure 4.18: Reduced coverage area caused by differences in cable signal delay

The lower the carrier frequency, the less susceptible the receiver is for differences in signal delays. The signal delays can be compensated by using the delay compensation switches on the radiators (see section *Determine the radiator delay switch positions*, page 60).

4.3 Plan an Integrus infrared radiation system

4.3.1 Rectangular footprints

Determining the optimal number of infrared radiators required to give 100% coverage of a hall can normally only be done by performing a site test. However, a good estimation can be made by using 'guaranteed rectangular footprints'. Figure 4.19 and 4.20 show what is meant by a rectangular footprint. As can be seen, the rectangular footprint is smaller than the total footprint. Note that in figure 4.20 the 'offset' X is negative because the radiator is actually mounted beyond the horizontal point at which the rectangular footprint starts.

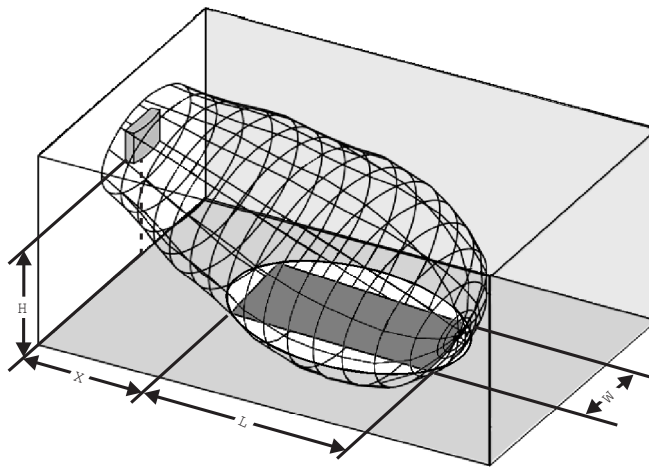


Figure 4.19: A typical rectangular footprint for a mounting angle of 15°

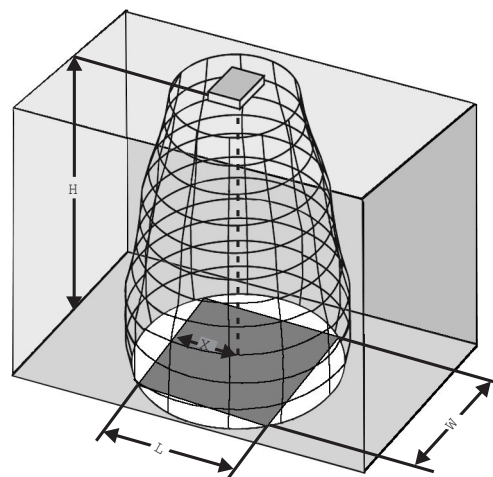


Figure 4.20: A typical rectangular footprint for a mounting angle of 90°

The guaranteed rectangular footprints for various number of carriers, mounting heights and mounting angles can be found in section *Guaranteed rectangular footprints*, page 85. The height is the distance from the reception plane and not from the floor.

Guaranteed rectangular footprints can also be calculated with the footprint calculation tool (available on the documentation DVD). The given values are for one radiator only, and therefore do not take into consideration the beneficial effects of overlapping footprints. The beneficial effects of reflections are also not included. As rule of thumb can be given for systems with up to 4 carriers that if the receiver can pick up the signal of two adjacent radiators, the distance between these radiators can be increased by a factor 1.4 approximately (see the next figure).

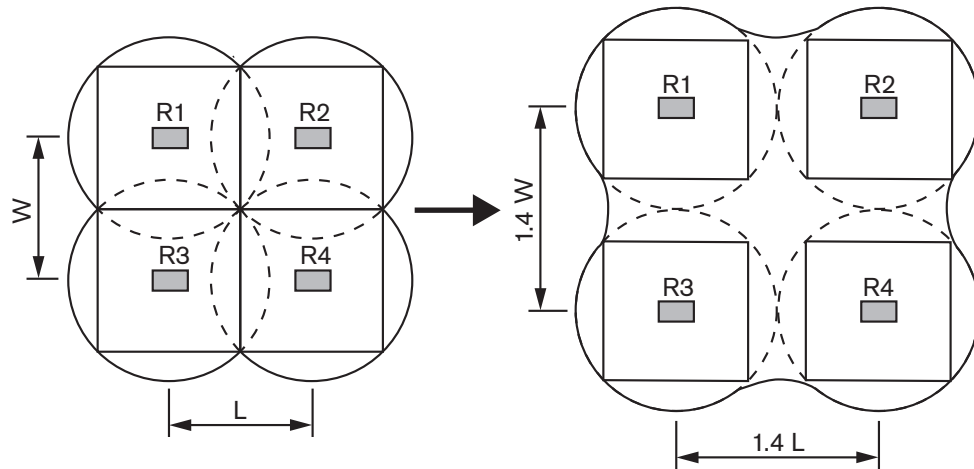


Figure 4.21: The effect of overlapping footprints

4.3.2

Plan radiators

Use the following procedure to plan the radiators:

1. Follow the recommendations in section *Aspects of Infrared distribution systems*, page 23 in order to determine the positioning of the radiators.
2. Look up (in the table) or calculate (with the footprint calculation tool) the applicable rectangular footprints.
3. Draw the rectangular footprints in the lay-out of the room.
4. If the receiver can pick up the signal of two adjacent radiators in some areas, determine the overlap effect and draw the footprint enlargement(s) in the lay-out of the room.
5. Check whether you have sufficient coverage with the radiators at the intended positions.
6. If not so, add additional radiators to the room.

See the figures 4.14, 4.15 and 4.16 for examples of a radiator lay out.

4.3.3

Cabling

Signal delay differences can occur due to differences in the cable length from the transmitter to each radiator. In order to minimize the risk of black spots, use equal cable length from transmitter to radiator if possible (see the next figure).

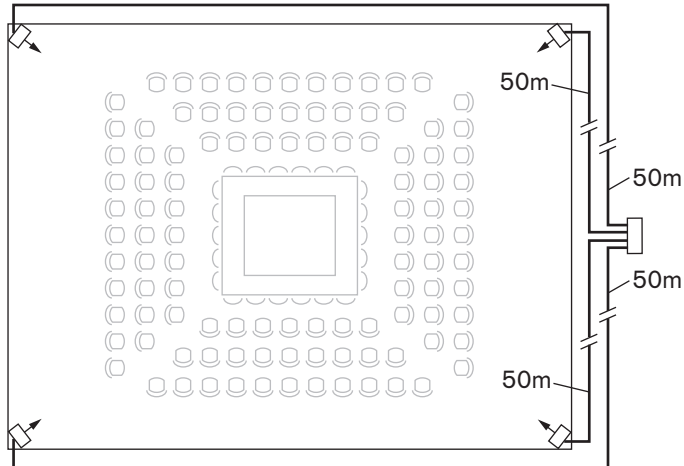


Figure 4.22: Radiators with equal cable length

When radiators are loop-through connected, the cabling between each radiator and the transmitter should be as symmetrical as possible (see the next two figures). The differences in cable signal delays can be compensated with the signal delay compensation switches on the radiators.

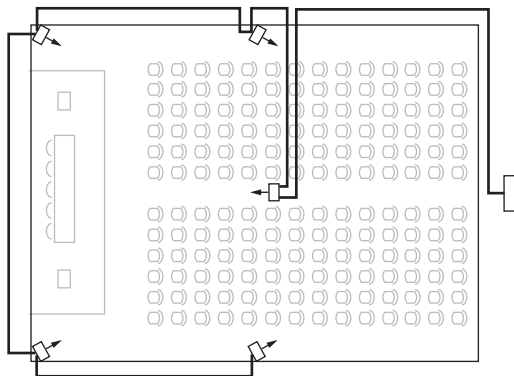


Figure 4.23: Asymmetrical arrangement of radiator cabling (to be avoided)

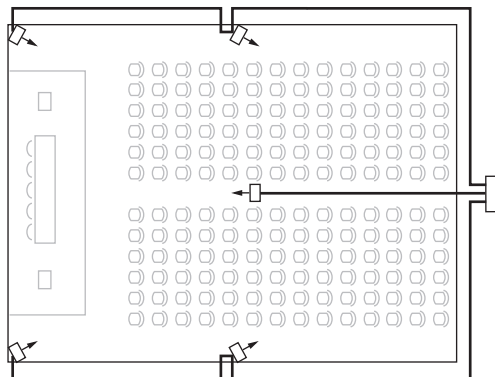


Figure 4.24: Symmetrical arrangement of radiator cabling (recommended)

5 Installation

5.1 Integrus Transmitters

The transmitter is suitable for either table-top or 19-inch rack-mounted use. Four feet (for table top use) and two mounting brackets (for rack mounting) are supplied. The mounting brackets can also be used to mount the transmitter to a flat surface.

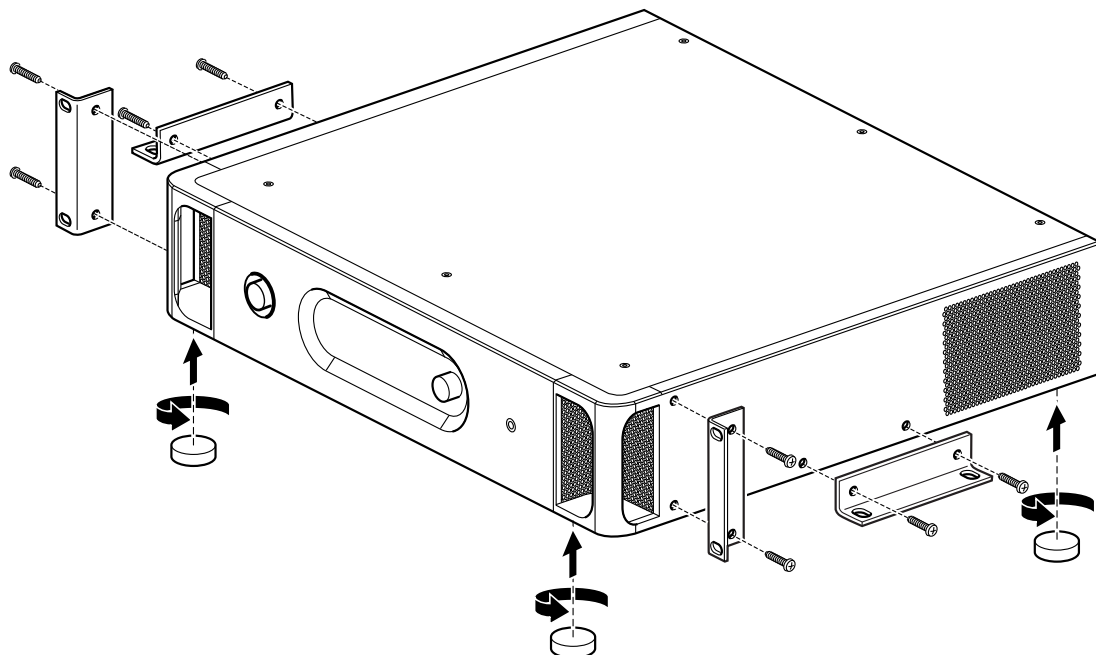


Figure 5.1: Transmitter with optional mounting brackets and table-top feet

5.2 Audio input and Interpreter module

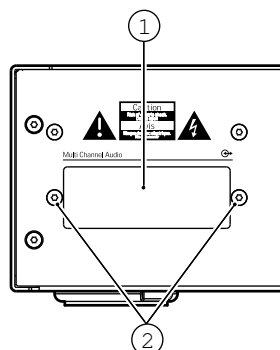


Figure 5.2: Module slot cover

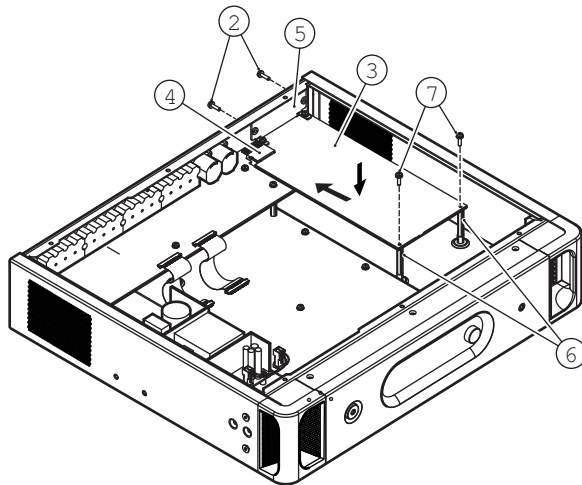


Figure 5.3: Mounting of the module in the transmitter housing

Follow the instructions below to mount the module in the transmitter housing. The numbers refer to the two figures above.



Danger!

Before opening the transmitter housing, make sure that the mains power and all other connections are disconnected!



Warning!

ICs and many other electronic components are susceptible to electrostatic discharge (ESD). Take preventive measures when handling the interface modules. Keep the PCBs as long as possible in their protective packing. Wear an anti-ESD bracelet.

1. Remove the top cover of the transmitter housing.
2. Remove the module slot cover (1) at the back of the transmitter. Keep the screws (2).
3. Insert the module (3) (with the components faced down) into the transmitter housing and push it firmly into the PCB connector (4).
4. Fasten the slot cover (5) to the back of the transmitter housing. Use the screws (2) from step 2.
5. Fasten the module's PCB to the distance studs (6). Use the screws (7) provided with the module.
6. Close the transmitter housing.



Warning!

To prevent damage to the PCB connectors (4), be sure that the connectors are aligned properly before pushing the module in.

5.3 Medium and High Power Radiators

Radiators in permanent installations can be either fixed to a wall, hung under a ceiling or balcony or secured to any sturdy material, using the suspension bracket supplied with the radiator. The mounting angle can be adjusted for optimal coverage. For wall mounting a separate bracket (LBB 3414/00) is also required. In non-permanent installations, a floor stand can be used.



Warning!

When you install the radiator in a ceiling, you must leave at least 1 m³ of free space around the back of the radiator. To prevent the radiator from becoming too hot, make sure that there is a good airflow in this free space.

Always ensure that natural airflow is not obstructed by ceilings, walls etc. when determining the position of the radiator. Leave plenty of space around the radiator to prevent it becoming too hot.

Follow the instructions below to mount a radiator:

1. Attach the mounting plate to the suspension bracket, see section *Attach mounting plate to the suspension bracket, page 36*
2. Attach the suspension bracket to the radiator, see section *Attach the suspension bracket, page 37*
3. Do one of the following:
 - Mount the radiator on a floor stand, see section *Mount radiator on a floor stand, page 37*
 - Mount the radiator on a wall, see section *Mount radiator on a ceiling, page 40*
 - Mount the radiator on the ceiling, see section *Attach mounting plate to the suspension bracket, page 36*
 - Mount the radiator on top of a horizontal surface, see section *Mount radiator on horizontal surfaces, page 40*
4. Secure the radiator with a safety cord, see section *Secure the radiator with safety cord., page 40*

5.3.1

Attach mounting plate to the suspension bracket

In case of mounting on a floor stand and wall mounting, it is necessary to attach a mounting plate to the suspension bracket.

The place of the mounting plate depends on the intended type of mounting.

- Refer to *Mount radiator on a floor stand*, page 37 in case of mounting on a floor stand.
- Refer to *Mount radiator on a wall*, page 38 in case of wall mounting.

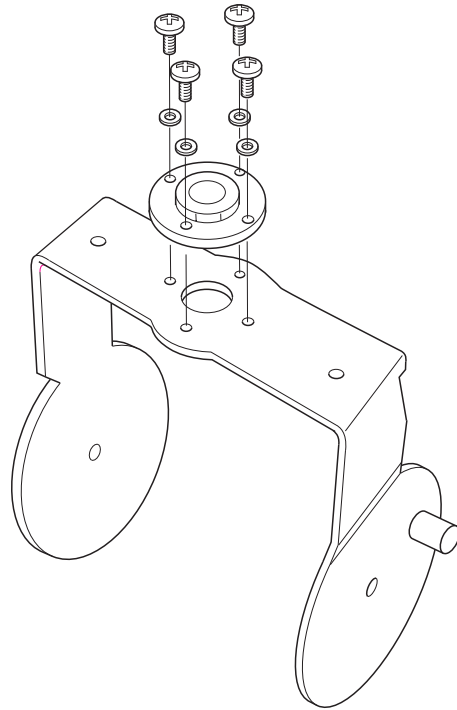


Figure 5.4: Attaching the plate to the suspension bracket in case of mounting on a floor stand

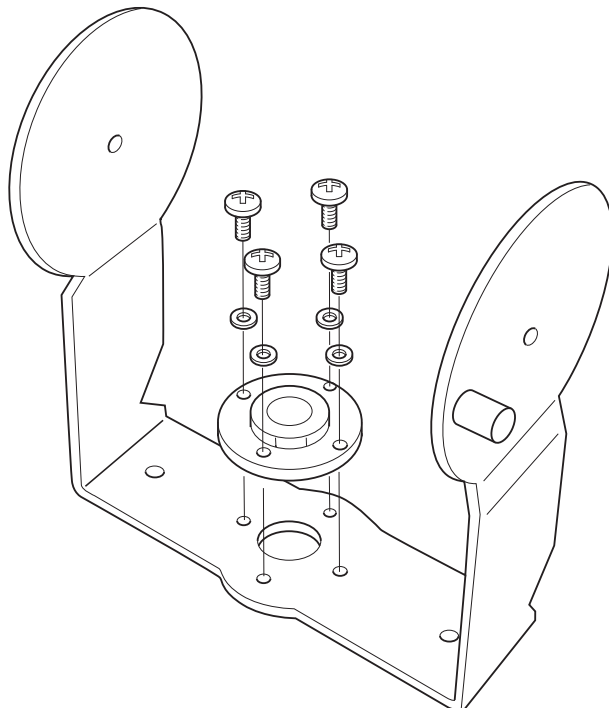


Figure 5.5: Attaching the plate to the suspension bracket in case of wall mounting

5.3.2 Attach the suspension bracket

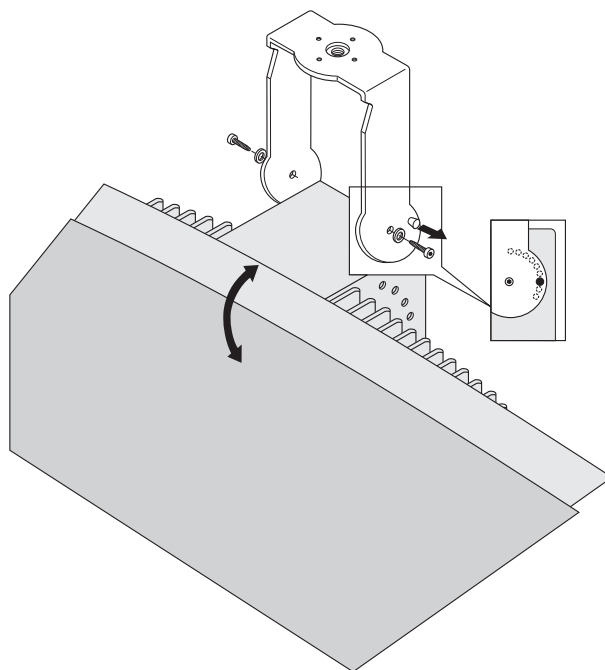


Figure 5.6: Attaching the suspension bracket to the radiator

First assemble the supplied suspension bracket and connect it to the radiator (see section *Attach mounting plate to the suspension bracket*, page 36 and the figure above). This bracket is attached to the radiator by two bolts with washers. There are corresponding holes on the back of the radiators. There is also a spring-loaded plunger (indicated by a black arrow in the figure above), located above the bolt hole on the right-hand arm of the bracket, which is used for adjusting the angle of the radiator (shown in inset in the figure above). There are corresponding holes on the back of the radiator for accepting this plunger. The mounting angle can be adjusted in steps of 15°.

5.3.3 Mount radiator on a floor stand

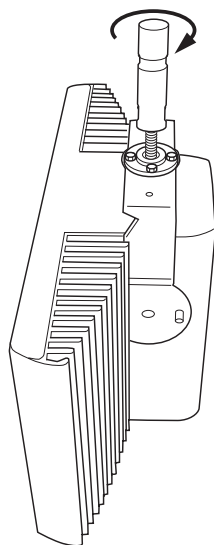


Figure 5.7: Attaching the stud of a floor stand to the suspension bracket of the radiator

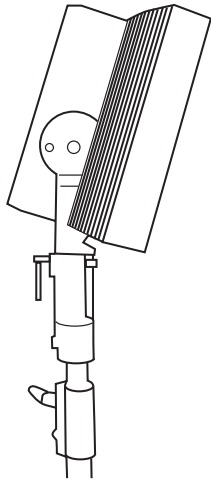


Figure 5.8: Attaching the radiator inclusive suspension bracket and stud to the floor stand

The top of the floor stand is screwed into the suspension bracket (see previous figure). The bracket is supplied with both metric and Whitworth threaded plates, and is therefore compatible with most standard floor stands. For floor stands, the mounting angle can be set at 0°, 15° or 30°.

5.3.4

Mount radiator on a wall

For wall mounting, an extra wall bracket (LBB 3414/00) is required (must be ordered separately). This bracket is attached to the wall by means of four bolts (see the next figure).

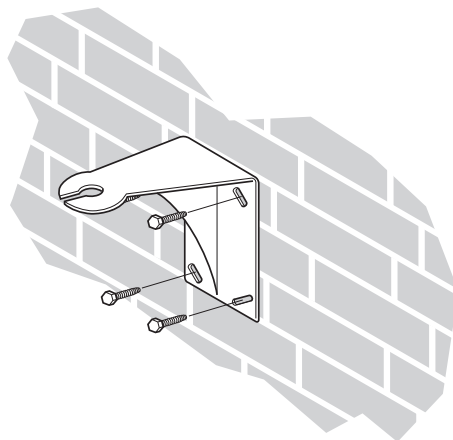


Figure 5.9: Attaching the wall mounting bracket to a wall



Notice!

The four bolts used to attach the bracket must each be able to withstand a pull-out force of 200 kg (440 lb). The bolts and plugs delivered with the LBB 3414/00 wall bracket are only intended for mounting the unit on a solid brick or concrete wall.

Four holes of 10 mm in diameter and 60 mm in depth must be drilled using the drilling pattern (see the next figure).

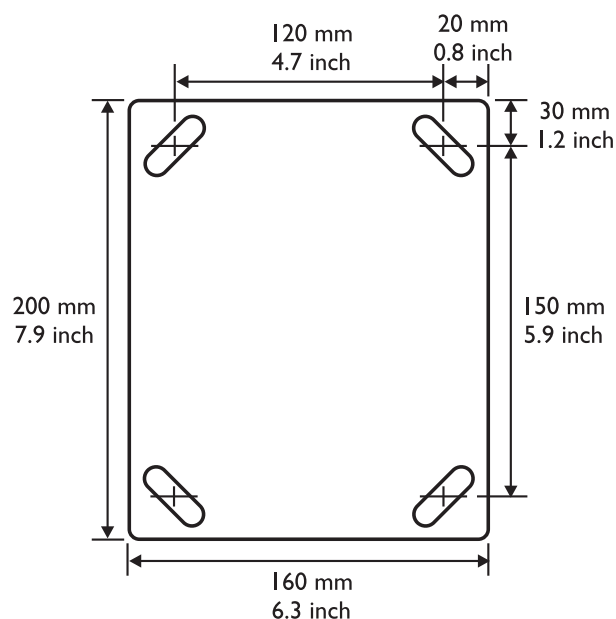


Figure 5.10: LBB 3414/00 wall mounting bracket showing dimensions and drilling pattern

The radiator (plus suspension bracket) is attached to the wall bracket by sliding the mounting bolt over the slot on the wall bracket and then tightening it (see the next figure). A split pin is then inserted into a small hole in the bolt to stop it from working loose (see inset in the next figure).

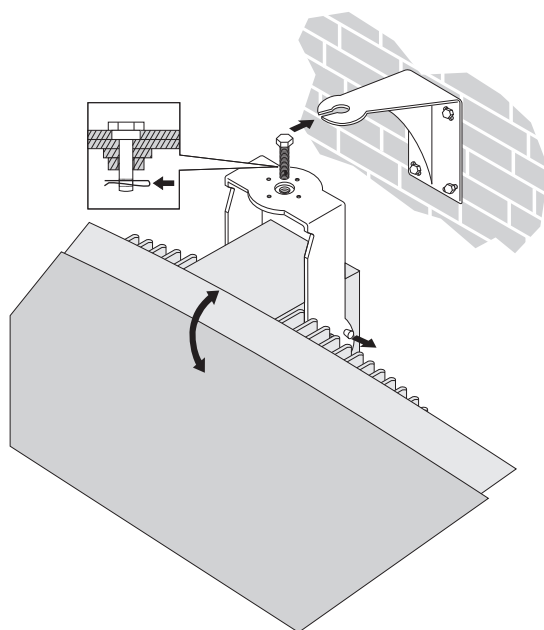


Figure 5.11: Attaching the radiator to the wall mounting bracket

The vertical angle of the radiator can be adjusted between 0 and 90° in steps of 15°. The horizontal orientation of the radiator can be adjusted by loosening the bolt then turning the radiator to the required position.

5.3.5 Mount radiator on a ceiling

The radiators can be attached to the ceiling using the supplied suspension bracket. This ensures enough space for a proper air flow around the radiator. Mounting a radiator in the ceiling will in most cases require a forced air flow by means of a ventilator to prevent overheating. If this is not possible, switch the radiator to half power.

5.3.6 Mount radiator on horizontal surfaces

When the radiator has to be positioned a horizontal surface (e.g. on top of an interpreter booth), the distance between the radiator and the surface must be at least 4 cm (1.5 inch) to enable enough air flow around the radiator. This can be achieved by using the suspension bracket as a support. If this is not possible, switch the radiator to half power. If the radiator is used at full power on top of an interpreter booth, the ambient temperature must not exceed 35° C.

5.3.7 Secure the radiator with safety cord.

The radiator is supplied with a safety eye to secure the radiator with a safety cord (not supplied).

1. Mount the safety eye properly in the hole of the radiator.
2. Make sure that: The minimum strength of the safety cord, mounting material, shackle and supporting building structure should withstand 1,500 N. The length of the safety cord is not more than 20 cm longer than needed.
3. Mount the safety cord to the safety eye.
4. Mount the safety cord to the supporting building structure.

Warning!



Suspending any object is potentially dangerous and should only be attempted by individuals who have a thorough knowledge of the techniques and regulations of rigging objects overhead. Bosch strongly recommends that radiators be suspended taking into account all current national, federal, state and local regulations.

It is the responsibility of the installer to ensure that radiators are safely installed in accordance with all such regulations. If radiators are suspended, Bosch strongly recommends that the installation is inspected at least once a year. If any sign of weakness or damage is detected, remedial action should be taken immediately.

5.4 Integrus receivers

The infrared receivers can operate with disposable batteries (2x AA-size alkaline cells) or with a rechargeable battery pack (LBB 4550/10).

Insert the batteries or the battery pack in the receiver with the correct polarity as indicated in the battery compartment. The battery pack has a separate connection cable which must be connected to the receiver. When this connection is not present, the charging circuitry in the receiver will not work. This also prevents the unwanted charging of disposable batteries. The battery pack has a temperature sensor which prevents overheating during charging.

For more information about charging the battery pack see section *Integrus Charging Units*, page 71.



Notice!

Disposable batteries and battery packs at the end of their technical lives should be discarded with due care for the environment. When possible, take batteries to a local recycling station.

5.5 Integrus Charging Units

Mount charging cabinet on a wall

LBB 4560/50 is suitable for either table-top or wall-mounted use.

It can be wall-mounted using 5 mm (0.19 inch) screws, with a head diameter of 9 mm (0.35 inch). The screws and plugs delivered with the LBB 4560/50 are designed to mount the unit on a solid brick or concrete wall. Two holes, 8 mm in diameter and 55 mm in depth, must be drilled 500 mm apart (see the next figure).



Warning!

To comply with UL and CSA regulations, the charging cabinets must be mounted in such a way that they can be easily removed by hand in case of emergency.

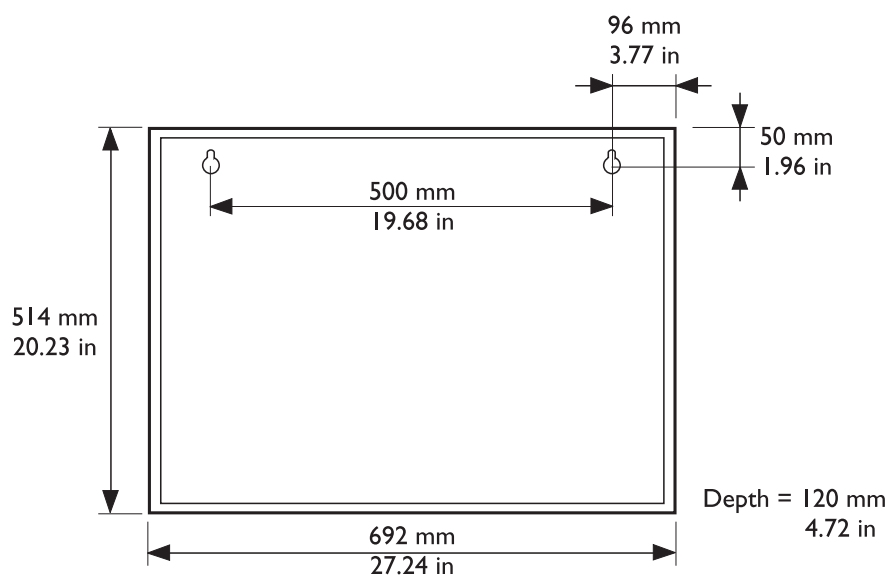


Figure 5.12: Charging cabinet mounting dimensions

6 Connection

6.1 Integrus Transmitters

This section gives an overview of typical system connections using the INT-TX range transmitter:

- The DCN Next Generation system
- Other external audio sources
- An emergency signal switch
- Another transmitter
- Radiators

6.2 Connect the DCN Next Generation system

The transmitter can be directly connected to the optical network of the DCN Next Generation conference system. Use an optical network cable to connect one of the optical network sockets of the transmitter to the optical network (see the next figure). The network mode must be enabled with the configuration menu (see section *Set network mode (4B)*, page 52).

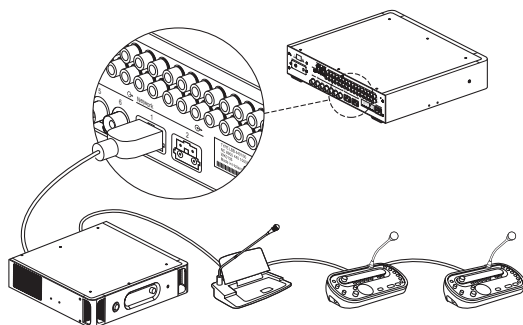


Figure 6.1: Connecting the optical network to the modular IR transmitter



Notice!

See the DCN Next Generation Operating Manual for more information about connecting the transmitter in the optical network.

The transmitter needs to be downloaded with the same version firmware via the Central Control Unit.

6.3 Connect other external audio sources

The transmitter has up to 32 audio inputs (depending on the transmitter type) to interface with external asymmetrical audio sources, such as congress systems from other manufacturers or for music distribution. The audio signals (stereo or mono) are connected to the audio input cinch connectors.

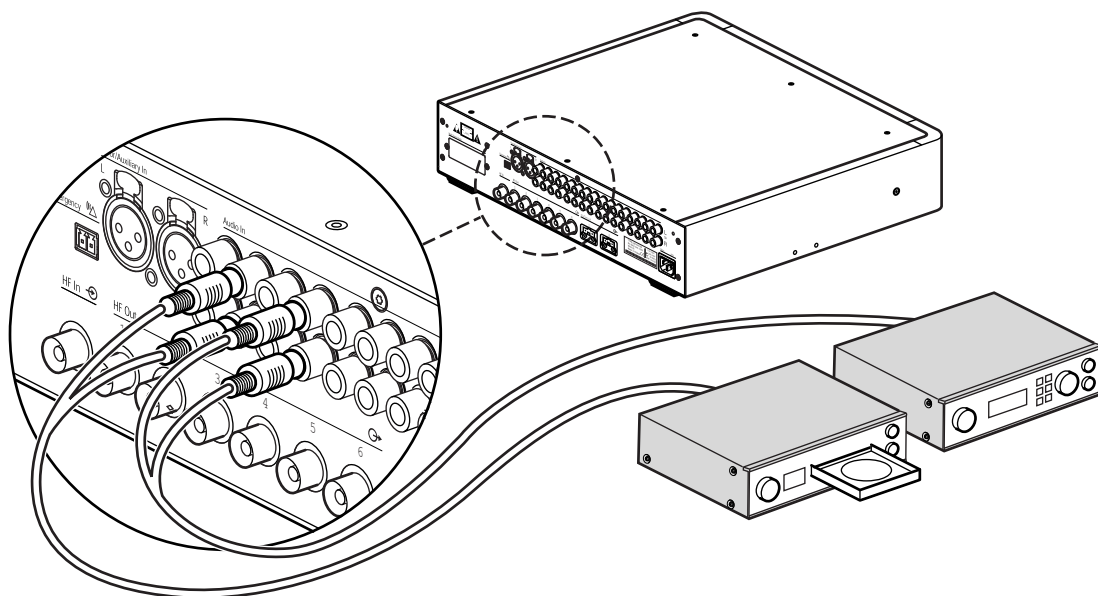


Figure 6.2: Connecting external audio sources to the Modular IR transmitter



Notice!

When the cinch audio inputs are used in combination with inputs via the audio interface module, the signals on corresponding channels are mixed. This situation should normally be avoided by using higher-numbered cinch audio inputs.

6.4 Connect an emergency signal

To use the emergency signal function, a switch (normally-open) must be connected to the emergency switch connector. The reaction of the transmitter on a closed switch depends on the configuration of the auxiliary inputs (see also section *Configure auxiliary inputs (4I)*, page 57):

- If the auxiliary input is 'Mono + Emergency', the audio signal on the Aux-Right input is distributed to all output channels, overriding all other audio inputs.
- If the auxiliary input is 'Stereo' or 'Stereo to Mono', the audio signals on the Aux-Left and Aux-Right inputs are distributed to all output channels, overriding all other audio inputs.

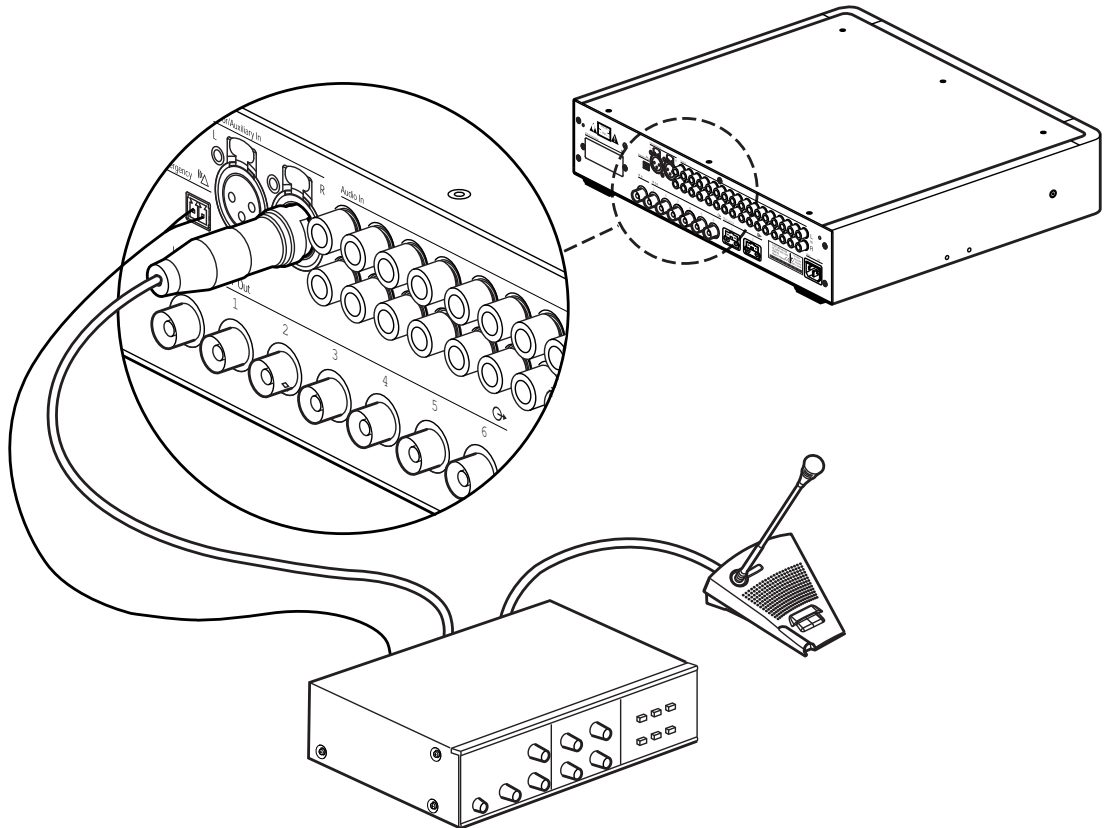


Figure 6.3: Connecting an emergency signal



Notice!

When the network mode is enabled (see section *Set network mode (4B)*, page 52), the emergency signal function is not available when the control unit of the DCN Next Generation conference system is switched off or defective.

6.5 Connect to another transmitter

The transmitter can be operated in slave mode to loop-through the IR radiator signals from a master transmitter. One of the four radiator outputs of the master transmitter is connected with an RG59 cable to the radiator signal loop-through input of the slave transmitter. The Transmission mode of the slave transmitter must be set to 'Slave' (see section *Set transmission (4A)*, page 52).

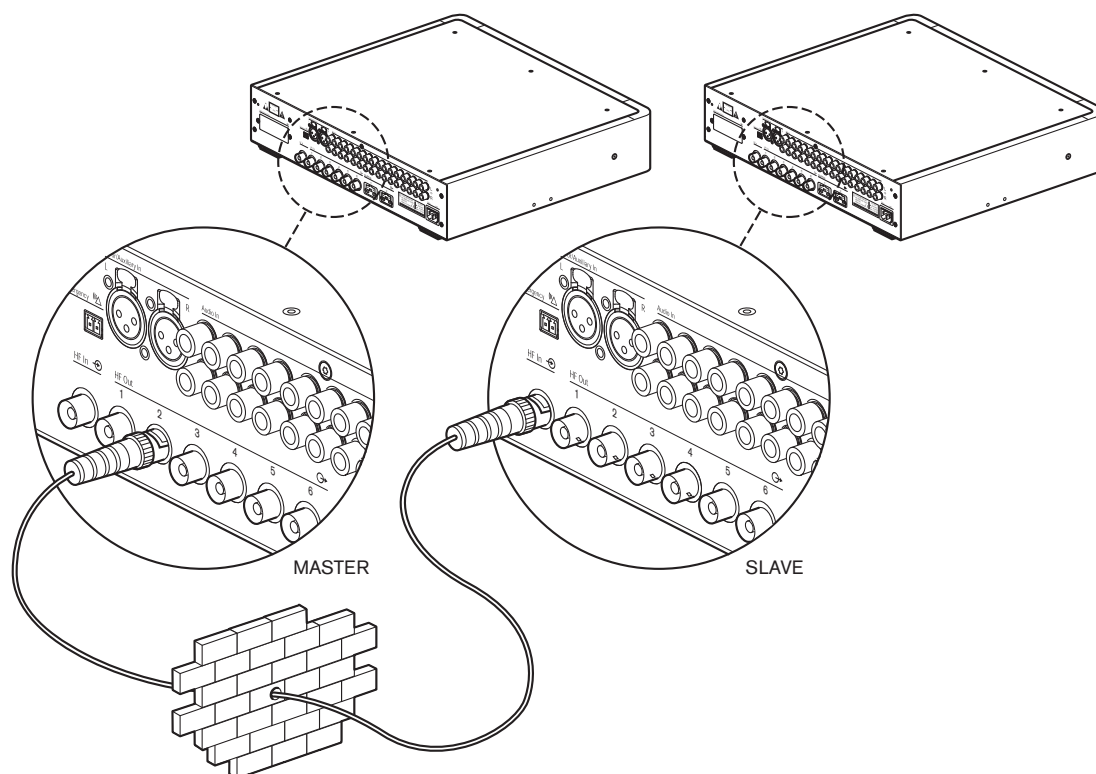


Figure 6.4: Connecting to another transmitter

6.6 Connect radiators

The transmitter has six BNC HF Output connectors labeled 1, 2, 3, 4, 5 and 6 on the rear panel. All six outputs are functionally identical. They can each drive up to 30 radiators (LBB 4511/00 and/or LBB 4512/00) in a loop-through configuration. The radiators are connected with RG59 cables. The maximum cable length per output is 900 m (2970 ft) to the last radiator. Automatic cable termination is achieved by a built-in switch in the BNC connectors on the radiator.

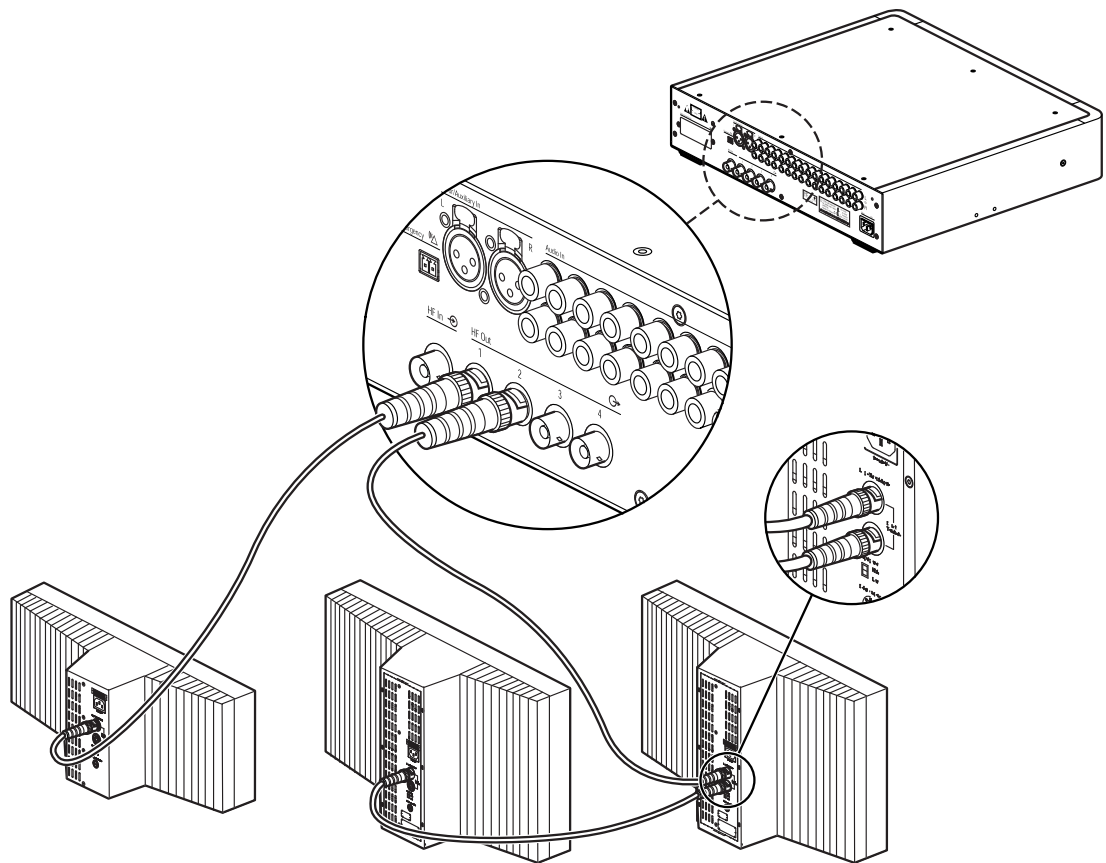


Figure 6.5: Loop-through connection of radiators



Notice!

For the automatic cable termination to work, never leave an open-ended cable connected to the last radiator in a loop-through chain.

When connecting infrared radiators, do not split the cable, else the system will not function correctly.

Analog IR radiators LBB 3510/05, LBB 3511/00, and LBB 3512/00 can be used with Integrus, with the following limitations:

- Not more than the first 4 carriers can be transmitted.
- Not more than 100 m cable length from transmitter to last radiator.
- Directly connection of the radiators to the transmitter with equal cable length. In loopthrough connection, the total cable length from the first to the last radiator may not exceed 5 meters. Reason: there are no facilities on this radiator for compensating the cable signal delay.

- Don't use this radiator in combination with LBB 4511/00 and LBB 4512/00 radiators in one system, as the internal signal delay of these radiators are different.
- No automatic cable termination: the termination plug has to be connected to the last radiator in a trunk.
- No communication of the radiator status to the transmitter.

7 Configuration

7.1 Integrus transmitter

7.1.1

Overview

All configuration and operation options of the transmitter are set via an interactive menu, using a 2x16 character LCD display and a 'turn-and-push' menu button. The next figure gives an overview of the menu structure. A general description of how to use the menu is given in section *Navigate through the menu*, page 49. Some examples are given in section *Example*, page 50. The detailed descriptions of all menu items can be found in section *Setup the transmitter*, page 51.



Figure 7.1: Menu overview

7.1.2

Navigate through the menu

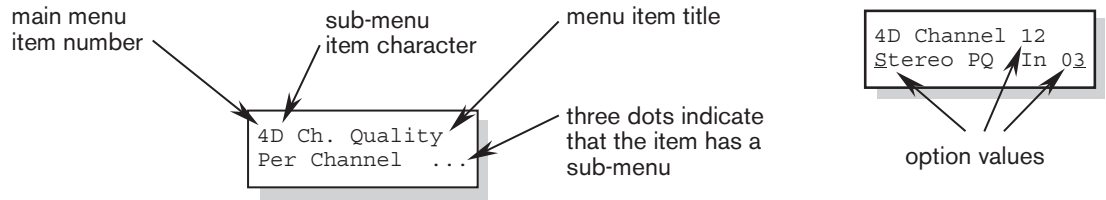


Figure 7.2: Menu item screen elements

Operating the menu is always a sequence of alternating turns and pushes:

Turn the button to:

- Cycle through the menu items within a menu (the menu item number and title on the first line is blinking).
- Go to a settable option within a menu item (a blinking cursor moves through the menu screen).
- Cycle through the available values for a settable option (the value is blinking).

Push the button to:

- Confirm a chosen menu item (the menu item number and title stops blinking, a blinking cursor appears).
- Go to a sub-menu (the sub-menu item character starts blinking).
- Confirm the selection of a settable option (the cursor disappears, the option value starts blinking).
- Confirm a selected value for a settable option (the value stops blinking, the cursor appears again).

After 3 minutes of inactivity, the display automatically switches back to the first item of the Main menu (Transmitter Status).

Each menu item is identified by a number (for the Main menu) or by a number plus a character (for the sub-menus). The item identification can be found at the start of the first line and is used to navigate to and from sub-menus.

Most menu items have one or more settable configuration options. The value of an option can be changed by selecting a value from a list of available values.

To navigate through the main menu:

1. Turn the button to move through the Main menu items. The item number and title starts blinking. (The first item, Transmitter Status, doesn't blink.)

To jump to a sub-menu:

1. Navigate in the Main menu to an item with three dots (e.g. 'Setup...').
2. Push the button to go to the sub menu. The submenu item character and title starts blinking



Notice!

To enter the Setup sub-menu, push and hold the button for at least 3 seconds.

To navigate through a sub-menu:

1. Turn the button to move the cursor to the submenu item character.
2. Push the button. The item character and title starts blinking.

3. Turn to select another sub-menu item character.
4. Push to confirm the selection.

To change the option values:

1. Navigate to the applicable menu item.
2. Turn the button to move the cursor to the option value you want to change.
3. Push the button to activate the option. The option value starts to blink.
4. Turn the button to select a new option value.
5. Push the button to confirm the new value. The option value stops blinking.
6. Turn the button to move the cursor to another settable option (when available) and repeat steps 3 to 5.

To jump back from a sub-menu to an item of the main menu:

1. Turn the button to move the cursor to the Main menu item number.
2. Push the button. The item number and title starts blinking.
3. Turn to select another item number.
4. Push to confirm the selection.

When you are turning counter-clockwise through submenu items, the display jumps automatically to the Main menu after you have reached the first item (A) of the sub-menu.

Example:

<i>4C Nr. of Ch.</i> 32 Channels	<i>4A Transmission</i> On	<i>4 Setup</i> ...	<i>3 Enquiry</i> ...
--	-------------------------------------	---------------------------	--------------------------------

To jump back from an item of the main menu to the Transmitter status:

1. Turn the button to the < Back screen.
2. Push the button to go to the Transmitter Status.

7.1.3

Example

The example below shows how to set channel 11 to transmit a Stereo signal in Premium Quality, using audio inputs 14 (L) and 15 (R) as source.

- Each step shows the text on the display and the action to go to the next step.
- Bold text in italics (**text**) indicates that the text is blinking.
- An underscore (_) indicates the position of the cursor.
- The example starts at the Transmitter Status screen.
- See also section *Set channel quality and assign inputs to channels (4D)*, page 54.

Transmitter 32 Channels	1. Turn the button to select the 'Setup' item (4) in the Main menu.
<i>4 Setup</i> ...	2. Push and hold the button for 3 seconds to go to the 'Setup' sub-menu.
<i>4A Transmission</i> On	3. Turn to select the 'Channel Quality' sub-menu item (4D).
<i>4D Ch. Quality</i> All Mono SQ	4. Push to confirm.
<i>4D Ch. Quality</i> All Mono SQ	5. Turn to move the cursor to the option on the second line.
<i>4D Ch. Quality</i> <u>A</u> ll Mono SQ	6. Push to confirm.

```
4D Ch. Quality
All Mono SQ
```

```
4D Ch. Quality
Per Channel ...
```

```
4D Channel 00
Mono SQ In 00
```

```
4D Channel 11
Mono SQ In 00
```

```
4D Channel 11
Mono SQ In 10
```

```
4D Channel 11
Mono SQ In 10
```

```
4D Channel 11
Mono SQ In 10
```

```
4D Channel 11
Stereo PQ In 10
```

```
4D Channel 11
Stereo PQ In 12
```

```
4D Channel 11
Stereo PQ In 12
```

```
4D Channel 11
Stereo PQ In 12
```

```
4D Channel 11
Stereo PQ In 14
```

```
4D Channel 11
Stereo PQ In 14
```

```
4D Channel 11
Stereo PQ In 14
```

```
4 Setup ...
```

```
< Back ...
```

```
Transmitter
32 Channels
```

7. Turn to select the option value 'Per Channel ...'.

8. Push to go to the 'Channel' sub-menu (4C).

9. Turn to select the required channel number (11).

10. Push to confirm.

11. Turn to move the cursor to the quality option.

12. Push to confirm.

13. Turn to select the required quality value (Stereo PQ).

14. Push to confirm. *

15. Turn to move the cursor to the input number.

16. Push to confirm.

17. Turn to select the required input number (14).

18. Push to confirm.

19. Turn to move the cursor to the Main menu item number (4).

20. Push to confirm.

21. Turn to select the < Back screen.

22. Push to confirm.

23. Ready.

* Note that after selecting 'Stereo' as input mode (step 14) the input number changes automatically to the next even number (12), which is the input number of the left signal.

7.2 Setup the transmitter

The next sections give descriptions of the possible setup options. Each description is followed by the relevant menu items with detailed information per menu option. The default values (see section *Reset all options to factory default values (4P)*, page 59) are indicated by an asterisk (*) when applicable.

7.2.1 Main menu

The main menu contains the screens to the **operational menus** (see section *Integrus transmitter*, page 69) and to the **Setup sub-menu** (see sections *Set transmission (4A)*, page 52 and higher).

Menu Item	Description
Transmitter Status	Shows the transmitter status (see section <i>View transmitter status</i> , page 69)
1 Fault Status	Shows the radiator fault status (see section <i>Fault messages</i> , page 72)
2 Monitoring . . .	Go to the 'Monitoring' sub-menu (see section <i>Integrus Transmitter</i> , page 66)
3 Enquiry . . .	Go to the 'Enquiry' sub-menu (see section <i>Service requests</i> , page 75)
4 Setup . . .	Go to the 'Setup' sub-menu (see sections <i>Set transmission (4A)</i> , page 52 and higher)

7.2.2

Set transmission (4A)

The Transmission menu item (4A) is used to select which signals will be distributed over the channels. It is also possible to switch all channels off (Standby). When using an Integrus system with a DCN Next Generation system (see section *Set network mode (4B)*, page 52), the transmitter is automatically switched to 'Standby' when the connected DCN Next Generation system is switched off. When the DCN Next Generation system is switched on, the transmitter is automatically switched to 'On'.

Menu Item	Options	Description
4A Transmission	Mode:	
	- Standby	All channels are switched off, no signals are distributed.
	* - On	Normal transmission. Input signals are distributed on the channels as set in the Channel Quality sub-menu (4D).
	- Aux to All	The signals on the Auxiliary inputs are distributed on one carrier to all channels.
	- Test	A different test tone is distributed on each channel. The frequency increases with increasing channel number. For stereo channels the tone for left and right will also be different.
	- Slave	The radiator signal on the slave input is looped-through to all radiators.

7.2.3

Set network mode (4B)

The Network Mode menu item (4B) is used to enable the optical network connections. When the transmitter is connected to a DCN Next Generation conference system, the optical network connections must be enabled.

Menu Item	Options	Description
4B Network Mode	Mode:	
	- Standalone	Required when the transmitter is used as standalone device.
	- Enabled	Required when the transmitter is used in combination with DCN Next Generation or DCN wireless.

Notice!

In case 'Standalone' is selected and the transmitter is connected to a DCN Next Generation or DCN wireless system, the audio in the system can be disrupted.

In case 'Enabled' is selected, while no DCN Next Generation or DCN wireless system is connected, the transmitter will show the fault status "Network Error".

In case 'Enabled' is selected and the transmitter cannot connect to the optical network (e.g. because the control unit of the DCN Next Generation conference system is switched off), the emergency contact does not function.

7.2.4**Set number of channels (4C)**

Via sub-menu item 4C the number of channels that will be used can be set. Note that the maximum number of channels depends on the transmitter type (4, 8, 16 or 32 channels) and the chosen quality modes. When a DCN Next Generation or a DCN wireless system is connected to the transmitter, the number of channels can be automatically set by the connected system.

Menu Item	Options	Description
4C Nr. of Ch.	Nr. of channels	
	* - Automatic: nn	The number of used channels is set automatically to the maximum possible number of channels (depending on transmitter type and the selected quality modes). When a DCN Next Generation or a DCN wireless system is connected to the transmitter, the number of channels is determined by the settings of the connected system.
	- Manual: nn	Set the number of used channels (the maximum number depends on the transmitter type and the selected quality modes). An asterisk (*) is shown when the selected number is not possible because it is higher than the maximum number of channels.

7.2.5

Set channel quality and assign inputs to channels (4D)

The audio quality of the channels (mono/stereo, standard/premium) can be set in sub-menu 4D. The quality can be set the same for all channels or for each channel separately. Note that choosing stereo and/or premium quality uses more bandwidth and decreases the number of available channels (see section *Carriers and channels*, page 22). In stereo mode, the left signal is always an even numbered input. The next higher input number is used for the right signal. When the quality is set the same for all channels with the 'All Mono' or 'All Stereo' options, the inputs are assigned automatically to the channels as indicated in the table below:

All Mono		All Stereo		
Channel	Input	Channel	input L	Input R
00	00	00	00	01
01	01	01	02	03
...
31	31	15	30	31

With menu option 4D (Per Channel Settings), the assignment can also be done for each channel separately.

Menu Item	Options	Description
4D Ch. Quality	Quality:	
	* All Mono SQ	Set all channels to mono, standard quality.
	All Mono PQ	Set all channels to mono, premium quality.
	All Stereo SQ	Set all channels to stereo, standard quality
	All Stereo PQ	Set all channels to stereo, premium quality.
	Per Channel . . .	Select this option to go to the 'Per Channel Settings' menu.

If, in the network mode, stereo quality is selected, the floor language is assigned to the left channel and the translation is assigned to the right channel. This can be used for language learning applications.

Menu Item	Options	Description
4D Channel nn	Channel nr.:	
	00 ... 31	Select which channel to configure.
	Quality:	
	- Disabled	Disable selected channel.
	* - Mono SQ	Set selected channel to mono, standard quality.
	- Mono PQ	Set selected channel to mono, premium quality.
	- Stereo SQ	Set selected channel to stereo, standard quality.

Menu Item	Options	Description
	- Stereo PQ	Set selected channel to stereo, premium quality.
	Source:	
	In 00 .. 31	Select the audio input that should be distributed on the selected channel. For stereo signals, the input number of the left signal (even number) should be selected.
	On 00 .. 31	Select the optical network channel that should be distributed on the selected channel.

Notice!

An asterisk (*) is shown behind the channel number when the channel in the configured quality does not fit on the available carriers (see section *Carriers and channels*, page 22). With an optical network connected, an asterisk (*) is shown behind the input number and the channel number when the selected input can not be routed to the selected channel, due to the routing limitations of the hardware. The user has to browse through the inputs in order to determine which input can be routed to the selected channel.

Without an optical network connected, an asterisk (*) is shown behind the input number and the channel number when an optical network channel (On) is selected, or when an input is selected that can not be routed to the selected channel due to the routing limitations of the hardware (typically inputs 28, 29, 30 & 31 can not be routed to other carriers than carrier 7).

7.2.6**Language list (4E)**

The menu item 4E (Language list) is reserved for future use.

7.2.7**Set channel names (4F)**

The Channel Names menu (4F) selects channel names of the used channels. 'Automatic' is used exclusively in combination with DCN Next Generation. When 'Per Channel' is selected the user can set the channel name manually. The name can be a general term (for example 'Original', 'Info', or 'Radio') or a pre-defined language name.

Menu Item	Options	Description
4F Ch. Names ...		Push the button to go to the sub-menu.
4F Ch. Names ...	Automatic	The channel names are derived from the DCN-NG
	Per channel ...	Select to set the channel name per channel manually.
4F Channel 00	00..31	Select the channel to set the name for.
	* - 'Floor', 'Original'	Use this name for the channel that carries the original floor language.

Menu Item	Options	Description
	- 'Audio', 'Radio', 'TV', 'Info'	Choose these names when the system is used for music distribution.
	- language names	Choose from pre-programmed language names (list shows abbreviation and the English name of the language).

7.2.8

Disable or enable carriers (4G)

Normally the channels are automatically assigned to the available carriers. However, when the reception quality of a specific carrier is not good, that carrier can be disabled manually. The channels are then automatically re-assigned to the next available carriers. Each of the 8 carriers (0 to 7) can be disabled or enabled in the Carrier Settings menu (4G).

Menu Item	Options	Description
4G C.Settings ...		Push the button to go to the sub-menu.
4G Carrier n	Carrier nr.:	
	0 ... 7	Select which carrier to configure.
	Status:	
	- Disabled	The selected carrier is disabled (off).
	* - Enabled	The selected carrier is enabled (on).



Notice!

In case the receiver is set to start with number 1, the channel numbers in the receiver will be shown with an offset of 1 compared to the transmitter.

7.2.9

View carrier assignments (4H)

With menu option 4H the carrier assignment can be seen, i.e. which channels are transmitted on each carrier. Note that the number of channels that can be distributed on one carrier depends on the chosen quality mode. See examples below.

4H Carrier 1 Ch. 04 05 06 07

Channels 4, 5, 6, and 7 (all Mono MQ) are assigned to carrier 1.

4H Carrier 4 Ch. 16 17 -- --

*Channels 16 and 17 (both Mono MQ) are assigned to carrier 4.
Room for more channels on same carrier.*

4H Carrier 5 Ch. 18 18 19 19

Channels 18 and 19 (both Mono PQ) are assigned to carrier 5.

Menu Item	Options	Description
4H C.Overview ...		Push the button to go to the sub-menu.
4H Carrier n	Carrier nr.:	
	0 ... 7	Select which carrier to view.

Menu Item	Options	Description
	Channel numbers:	
	-00 ... 31 or --	Shows the channel numbers that are assigned to the selected carrier. The symbol '-' is used when less than 4 channels are assigned.

7.2.10

Configure auxiliary inputs (4I)

The way the signals on the auxiliary inputs (Aux.-L and Aux.-R) are handled can be set in the Aux. Input Mode menu (4I).

When the option 'Stereo' is chosen, the signals on both Aux. inputs are distributed as a stereo signal to all channels. This setting can for instance be used to transmit a music signal during breaks in a conference. Note that the Transmission mode must be set to 'Aux to All' (menu item 4A) to actually transmit this stereo signal.

The 'Stereo to Mono' and 'Mono+ Emergency' options can be selected when the transmitter is used in combination with an interpretation system. The Aux. input(s) will be distributed to the Symmetrical Audio Input and Interpreters Module. In this configuration the 'floor' signal should be connected to the Aux. inputs.

Menu Item	Options	Description
4I Aux. Input	Type:	
	* - Stereo	The Aux. inputs will be distributed in stereo to all channels when the transmission mode (menu item 1) is set to 'Aux to All'.
	- Stereo to Mono	The Aux-L and Aux-R inputs are combined into a mono signal and distributed to the Symmetrical Audio Input and Interpreters Module (when present).
	- Mono + Emergency	The Aux-L input is distributed to the Symmetrical Audio Input and Interpreters Module (when present). The Aux-R input is distributed as emergency signal to all channels when the emergency switch is closed.

7.2.11

Set sensitivity of the inputs (4J, 4K, 4L)

The sensitivity of the audio and Aux. inputs can be set in the Input Sensitivity menus (4J, 4K, 4L). The sensitivity can be set the same for all audio inputs (menu item 4L) or for each audio input separately.

Menu Item	Options	Value	Description
4J Level.Aux.L		Level:	
		-6 ... +6 dB	Set the required sensitivity for the left auxiliary input.
4K Level.Aux.R		Level:	

Menu Item	Options	Value	Description
		-6 ... +6 dB	Set the required sensitivity for the right auxiliary input.
4L Level Inputs	Mode:	Level:	
	- All	-6 ... +6 dB	Set the sensitivity of all audio inputs to a user defined level.
	- Per Input ...		Select this option to go to the 'Per Input Sensitivity Settings' menu.

The sensitivity screens also displays a level meter for a visual indication of the actual signal strength: ■= low level, ■= high level, ▲= overflow.

7.2.12

Enable / disable IR-monitoring (4M)

The mini IR-radiator at the front of the transmitter can be used for monitoring the IR-signal. When required (e.g. for security reasons) this option can be switched off (menu 4M).

Menu Item	Options	Description
4M Mini Radiator	Enabled	Enable the mini IR-radiator at the front of the transmitter.
	Disabled	Disable the mini IR-radiator at the front of the transmitter.



Notice!

The mini IR-radiator and the headphone output can also be permanently disabled by removing two resistors. Consult your regular service contact for more information.

7.2.13

Enable / disable headphone output (4N)

The headphone output at the front of the transmitter can be used for monitoring the input-and channel signals. When required (e.g. for security reasons) this option can be switched off in menu item 4N.

Menu Item	Options	Description
4N Headphone	Enabled	Enable the headphone output at the front of the transmitter.
	Disabled	Disable the headphone output at the front of the transmitter.

7.2.14

Choose transmitter name (4O)

The transmitter can be assigned a user-defined name. This name is used in the Transmitter Status screen. The name can be edited in the Unit Name menu (4O).

Menu Item	Options	Description
4O Unit Name	Name:	
	- Free text	Assign a user defined name to the transmitter (max. 16 characters). The default name is 'Transmitter'.

7.2.15 Reset all options to factory default values (4P)

Use menu item 4P to reset all options to the factory defaults. The user defined transmitters name, the user defined language names and the transmission mode are not reset. (The default values are indicated by an asterisk (*) in the menu descriptions.)

Menu Item	Options	Description
4P Defaults ...		Push the button to go to the sub-menu.
4P Defaults ...	Reset to defaults?	
	* - No	Cancel Reset.
	- Yes	Reset all options to the factory default value. The user defined transmitters name, the user defined language names and the transmission mode are not reset.

7.3 Integrus Radiators

7.3.1 Set the output power selection switch

The radiators can be switched to half power. This can be used when full power is not required, e.g. when a mobile system is used in a small conference venue.

Also switch a radiator to half power when an adequate air flow can not be guaranteed, e.g. when the radiator is mounted on top of an interpreters booth.

Reducing the power when possible saves energy and increases the lifetime.

When a radiator is in half power mode, half the number of IREDs are switched off, which results in a visible pattern as shown in the next figure.

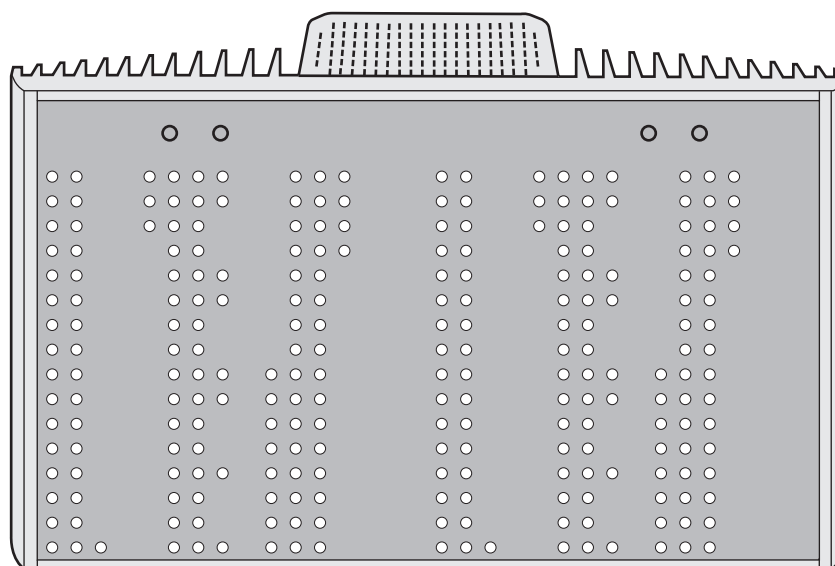


Figure 7.3: IRED pattern of radiator in half power mode.

7.3.2

Set the delay switches

Refer to *Determine the radiator delay switch positions*, page 60 how to determine the radiator delay switch positions.



Caution!

Turn the delay switches carefully to a new position until you feel that it clicks into position, to prevent that a switch is positioned between two numbers, which would result in a wrong delay setting.

7.4

Determine the radiator delay switch positions

As described in section *Overlapping footprints and black spots*, page 29, differences in the delays of the signals picked up by the receiver from two or more radiators can cause black spots as a result of the multi path effect.

The signals picked up by the receiver are delayed by:

- the transmission from transmitter to radiator through the cable (cable signal delay)
- the transmission from radiator to receiver through the air (radiation signal delay)
- for systems with two or more transmitters: the transmission through the slave transmitter(s)

To compensate the signal delay differences, the delay of each radiator can be increased.

These signal delays can be set with the delay switches at the back of the radiator.

The cable signal delays can be determined in the following two ways:

- by measuring the cable lengths
- by measuring the impulse response time with a delay measurement tool

In both cases the cable signal delays can be calculated manually and with the delay switch calculation tool (available on the documentation DVD).

It is not necessary to calculate the cable signal delay in case:

- the radiators are directly connected to the transmitter with equal cable length;
- radiators are loop-through connected, but with less than 5 m distance between the first and last radiator in a trunk, and with equal cable length between the first radiator in each trunk and the transmitter.

In these cases set the delay switches on all radiators to zero and determine whether to compensate for radiation signal delay (see section *Systems with more than 4 carriers and a radiator under a balcony*, page 65).

The next sections describe how to calculate the delay switch positions manually for systems with one transmitter, or two or more transmitters. See the delay switch calculation tool for the procedures how to calculate the delay switch positions automatically.



Notice!

The delay switch calculation tool eases the calculation of the delay switch positions.

7.4.1

System with one transmitter

There are two ways to determine the delay switch positions:

- Measuring the cable lengths
- Using a delay measuring tool

Both methods are described in the next sections.

**Notice!**

For systems with a cable length difference of more than 50 meters, it is recommended to use a measurement tool to determine the delay differences in order to calculate the delay switch positions.

Determining delay switch positions by measuring the cable lengths

Use the following procedure to determine the delay switch position based on cable lengths:

1. Look up the cable signal delay per meter of the used cable. The manufacturer specifies this factor.
2. Measure the lengths of the cables between the transmitter and each radiator.
3. Multiply the lengths of the cables between the transmitter and each radiator with the cable signal delay per meter. These are the cable signal delays for each radiator.
4. Determine the maximum signal delay.
5. Calculate for each radiator the signal delay difference with the maximum signal delay.
6. Divide the signal delay difference by 33. The rounded off figure is the signal delay switch position for that radiator.
7. Add delay switch positions for radiators under a balcony, if applicable (see section *Systems with more than 4 carriers and a radiator under a balcony*, page 65).
8. Set the delay switches to the calculated switch positions.

The next figure and table illustrate the calculation of the cable signal delay.

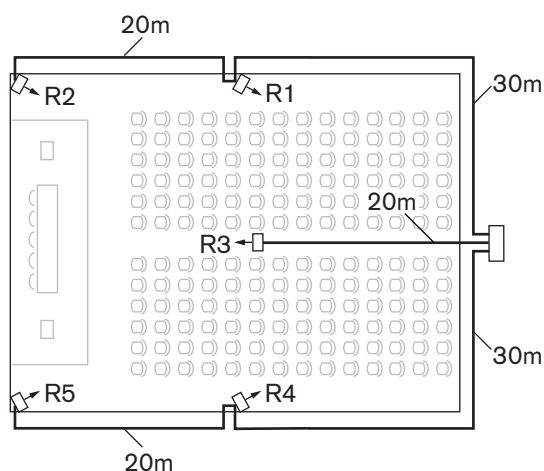


Figure 7.4: System with five radiators and measured cable lengths

Radiator number	Total cable length [m]	Cable signal delay per meter [ns/m]	Cable signal delay [ns]	Signal delay difference [ns]	Delay switch position
1	30	5.6	$30 \times 5.6 = 168$	$280 - 168 = 112$	$112 / 33 = 3.39 = 3$
2	$30 + 20 = 50$	5.6	$50 \times 5.6 = 280$	$280 - 280 = 0$	$0 / 33 = 0$
3	20	5.6	$20 \times 5.6 = 112$	$280 - 112 = 168$	$168 / 33 = 5.09 = 5$
4	30	5.6	$30 \times 5.6 = 168$	$280 - 168 = 112$	$112 / 33 = 3.39 = 3$
5	$30 + 20 = 50$	5.6	$50 \times 5.6 = 280$	$280 - 280 = 0$	$0 / 33 = 0$

Table 7.1: Calculation of the cable signal delays

**Notice!**

The used cable signal delay per meter is an example. Use the actual signal delay per meter in this calculation as specified by the manufacturer.

Determining delay switch positions by using a delay measuring tool

The most accurate way to determine the cable signal delays is to measure the actual signal delay for each radiator as described in the following procedure:

1. Disconnect the cable from a radiator output of the transmitter and connect this to a delay measurement tool.
2. Disconnect a radiator from this cable.
3. Measure the impulse response time (in ns) of the cable(s) between the transmitter and the radiator.
4. Reconnect the cable to the radiator and repeat steps 2 to 4 for the other radiators that are connected to the same transmitter output.
5. Reconnect the cable to the transmitter and repeat step 1 to 5 for the other radiator outputs of the transmitter.
6. Divide the impulse response times for each radiator by two. These are the cable signal delays for each radiator.
7. Determine the maximum signal delay.
8. Calculate for each radiator the signal delay difference with the maximum signal delay.
9. Divide the signal delay difference by 33. The rounded off figure is the delay switch position for that radiator.
10. Add delay switch positions to radiators under a balcony, if applicable (see section *Systems with more than 4 carriers and a radiator under a balcony*, page 65)
11. Set the delay switches to the calculated delay switch positions.

**Caution!**

Turn the delay switches carefully to a new position until you feel that it clicks into position, to prevent that a switch is positioned between two numbers, which would result in a wrong delay setting.

The next figure and table illustrate the calculation of the signal delays and the delay switch positions.

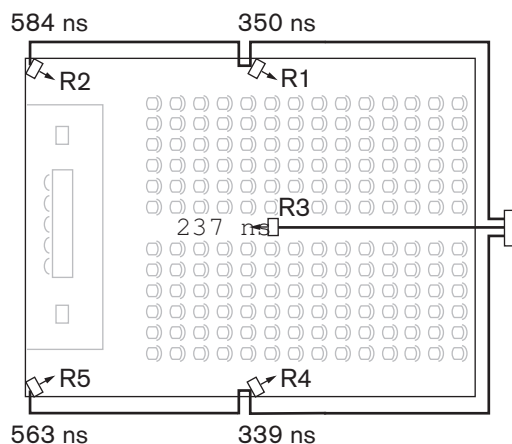


Figure 7.5: System with five radiators and measured impulse response times

Radiator number	Impulse response time [ns]	Cable signal delay [ns]	Signal delay difference [ns]	Delay switch position
1	350	$350/2=175$	$292-175=117$	$117/33=3.64=4$
2	584	$584/2=292$	$292-292=0$	$0/33=0$
3	237	$237/2=118$	$292-118=174$	$174/33=5.27=5$
4	339	$339/2=169$	$292-169=123$	$123/33=3.73=4$
5	563	$573/2=281$	$292-281=11$	$11/33=0.33=0$

Table 7.2: Calculation of the delay switch positions of a system with one transmitter



Notice!

The calculated delay switch positions based on impulse response time can differ from the calculated delay switch positions based on cable lengths. This is caused by the accuracy of the measurements and the accuracy of the cable signal delay factor per meter as specified by the manufacturer of the cable. If the impulse response time is measured correctly, the calculated delay switch positions will be the most accurate.

7.4.2

System with two or more transmitters in one room

When radiators in one multi purpose room are connected to two transmitters, an extra signal delay is added by:

- Transmission from master transmitter to slave transmitter (cable signal delay).
- Transmission through the slave transmitter.

Use the following procedure to determine the delay switch positions in a master-slave configuration:

1. Calculate the cable signal delay for each radiator, using the procedures for a system with one transmitter.
2. Calculate the signal delay of the cable between the master and the slave transmitter in the same way as for cables between a transmitter and a radiator.
3. Add to the cable signal delay of the cable between the master and the slave, the delay of the slave transmitter itself: 33 ns. This gives the master-to-slave signal delay.
4. Add the master-to-slave signal delay to each radiator connected to the slave transmitter.
5. Determine the maximum signal delay.
6. Calculate for each radiator the signal delay difference with the maximum signal delay.
7. Divide the signal delay difference by 33. The rounded off figure is the signal delay switch position for that radiator.
8. Add delay switch positions to radiators under a balcony, if applicable (see section *Systems with more than 4 carriers and a radiator under a balcony*, page 65)
9. Set the delay switches to the calculated delay switch positions.



Caution!

Turn the delay switches carefully to a new position until you feel that it clicks into position, to prevent that a switch is positioned between two numbers, which would result in a wrong delay setting.

**Notice!**

When a master-slave configuration is used for rooms which are always separated, the delay switch positions can be determined per system and the delay caused by transmission from master to slave transmitter can be ignored.

The next figure and tables and table 7.1 illustrate the calculation of the extra master-slave signal delay.

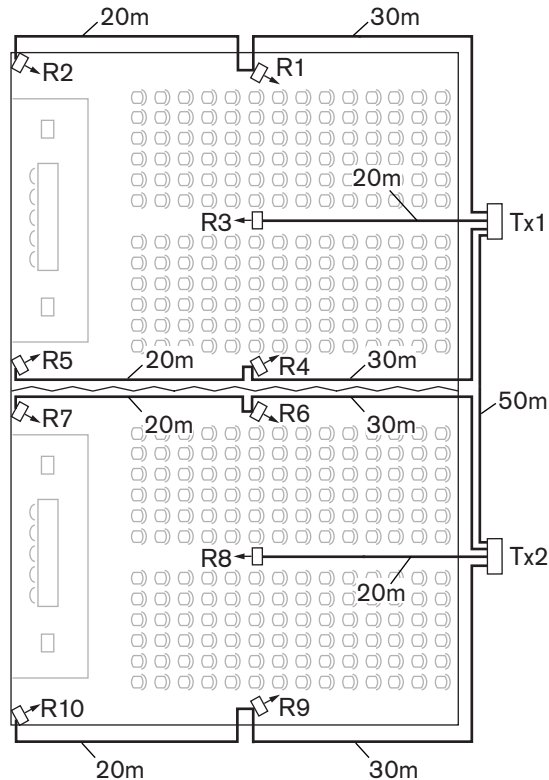


Figure 7.6: System with master and slave transmitter in multi purpose room

Cable length master-slave transmitter [m]	Cable signal delay per meter [ns/m]	Cable signal delay [ns]	Signal delay slave transmitter [ns]	Master-to-slave signal delay [ns]
50	5.6	$50 \times 5.6 = 280$	33	$280 + 33 = 313$

Table 7.3: Calculation of the master-to-slave signal delays

Radiator number	Trans-mitter	Master-to-slave signal delay [ns]	Cable signal delay [ns]	Total signal delay [ns]	Signal delay difference [ns]	Delay switch position
1	Master	0	168	$0 + 168 = 168$	$593 - 168 = 425$	$425 / 33 = 12.88 = 13$
2	Master	0	280	$0 + 280 = 280$	$593 - 280 = 313$	$313 / 33 = 9.48 = 9$
3	Master	0	112	$0 + 112 = 112$	$593 - 112 = 481$	$481 / 33 = 14.58 = 15$
4	Master	0	168	$0 + 168 = 168$	$593 - 168 = 425$	$425 / 33 = 12.88 = 13$

Radiator number	Transmitter	Master-to-slave signal delay [ns]	Cable signal delay [ns]	Total signal delay [ns]	Signal delay difference [ns]	Delay switch position
5	Master	0	280	$0+280=280$	$593-280=313$	$313/33=9.48=9$
6	Slave	313	168	$313+168=481$	$593-481=112$	$112/33=3.39=3$
7	Slave	313	280	$313+280=593$	$593-593=0$	$0/33=0$
8	Slave	313	112	$313+112=425$	$593-425=168$	$168/33=5.09=5$
9	Slave	313	168	$313+168=481$	$593-481=112$	$112/33=3.39=3$
10	Slave	313	280	$313+280=593$	$593-593=0$	$0/33=0$

Table 7.4: Calculation of the delay switch positions of a system with two transmitters

7.4.3

Systems with more than 4 carriers and a radiator under a balcony

The next figure illustrates a situation in which a radiation signal delay occurs and which can be compensated for. For systems with more than four carriers, add one delay switch position per 10 meter (33 feet) difference in signal path length to the radiators which are closest to the overlapping coverage area. In the next figure the signal path length difference is 12 meter. Add one delay switch position to the calculated switch position(s) for the radiator(s) under the balcony.

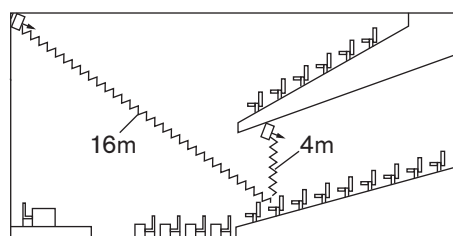


Figure 7.7: Radiation path length difference for two radiators

8 Testing

8.1 Integrus Transmitter

The Monitoring sub-menu (2) on the transmitter is used to set which signal is sent to the monitoring headphone output. It can be one of the inputs, one of the channels or no signal, see also section *Set transmission (4A)*, page 52.

Use the monitoring headphone of the transmitter to check the input audio signal in the transmitter, before it is sent to the receivers.

When the sensitivity of one of the inputs is being changed in the Setup menu (4I, 4J or 4K), or when assigning inputs to channels (menu 4D, Per Channel), the monitoring output automatically switches temporarily to that source, even when the option 'None' has been chosen. When the headphone output is disabled (see section *Enable / disable headphone output (4N)*, page 58), the output level can not be changed and the level indicator is not visible.

Menu Item	Option	Value 1	Value 2	Description
2A Source/ Volume	Source:			
	- In. nn	Input nr: 00 ... 31	Volume: -31 ... 0 dB	The signal from audio input nn is available on the monitoring headphone output.
	- Ch. nn	Channel nr: 00 ...31	Volume: -31 ... 0 dB	The signal on channel nn is available on the monitoring headphone output.
	- Aux.L		Volume: -31 ... 0 dB	The signal on the Aux. Left input is available on the monitoring headphone output.
	Aux.R		Volume: -31 ... 0 dB	The signal on the Aux. Right input is available on the monitoring headphone output.
	- None		Volume: -31 ... 0 dB	The monitoring headphone output is switched off during normal operation, but is active when the sensitivity of one of the inputs is being changed.

The 'Source/volume' screen also displays level meters (two for a stereo source, one for a mono source) for a visual indication of the actual signal strength:

■ = low level, ■ = high level, ▲ = overflow.

8.2 Integrus Receiver

The receivers can be switched to a test-mode to get an indication of the reception quality for each carrier separately. To activate the test-mode:

1. Push the channel selector to the Up-position
 2. Press the on/off button and hold both for ca. 2 seconds
 3. When in test-mode, switch between carriers by using the channel selector
- For each carrier the display shows a relative value of the signal strength, Figure of Merit(FOM), and a graphical quality indication symbol.

The reception quality can be assessed as follows:

Indication	Quality
00-39	Good reception. Very good audio quality.
40-49	Weak reception. Ticks in the audio.
50-90	No or bad reception. Poor audio quality.

The test mode is deactivated when the receiver is switched off.

8.3 Test the coverage area

An extensive reception quality test must be done to make sure that the whole area is covered with IR radiation of adequate strength and that there are no black spots. Such a test can be done in two ways:

Testing during installation

1. Check that all radiators are connected and powered up and that no loose cables are connected to a radiator. Switch the transmitter off and on to re-initialise the auto equalisation of the radiators.
2. Set the transmitter in the Test-mode (see section *Set transmission (4A)*, page 52). For each channel, a different test tone frequency will be transmitted.
3. Set a receiver on the highest available channel and listen via the headphones to the transmitted test tone.
4. Test all positions and directions (see next paragraph).

Testing during a meeting

1. Set a receiver in the Test-mode and select the highest available carrier. The quality of the received carrier signal is indicated on the display of the receiver (see section *Integrus Receiver*, page 67).
2. Test all positions and directions (see next paragraph). The quality indication should be between 00 and 39 (good reception).

Testing all positions and directions

With the transmitter and receiver in one of the two test modes, go around the conference hall and test the reception quality at every position where the infrared signals must be received. When an area is detected where there is bad reception or even no reception at all, three main causes must be considered:

Bad coverage

The receiver can not pick-up infrared radiation of adequate strength. This can be because the tested position is outside the footprint of the installed radiators or the radiation is blocked by obstacles such as a column, an overhanging balcony or other large objects.

Check that you used the correct footprints for the system design, that radiators with enough output power are installed and that a radiator is not accidentally switched to half power operation. When the bad reception is caused by a blocked radiation path, try to remove the blocking obstacle or add an extra radiator to cover the shaded area.

Black spots

The receiver picks-up IR signals from two radiators which cancel out each other.

The black spot can be identified by the observation that the bad reception only occurs along a specific line and/or when good reception returns when the receiver is rotated to another direction. This can be confirmed by keeping the receiver in the position and direction with the bad reception and then either shading-off the radiation from one radiator with your hand or switching off one radiator. If this improves the reception quality, then the black spot is causing the problem. Note that IR radiation that is reflected from a surface with a high reflectivity can also cause black spots.

Black spots can occur in case a transmitter is located in the same room as the radiators.

- In that case, disable the mini IR radiator of the transmitter with the configuration menu (see section *Enable / disable IR-monitoring (4M)*, page 58).
- Check that the signal delay compensation switches on the radiators are set to the correct value and that a switch is not accidentally positioned between two numbers.
- Re-check your system design. When necessary, reduce the distance between the two radiators that cause the problem and/or add an extra radiator.

Note that due to the physical characteristics of the signal distribution, it is not always possible to completely avoid black spots.

Interference from IR systems

IR assisted hearing systems and IR microphones operating at frequencies above 2 MHz, can disturb the reception at the lowest carriers. If such is the case, disable the lowest two carriers (see section *Disable or enable carriers (4G)*, page 56) and re-check the reception.

9 Operation

9.1 Integrus transmitter

9.1.1 Start-up

When the transmitter is switched on, the display shows the Transmitter Status screen, which is the first item of the Main menu (see section *Main menu*, page 51). The display also goes to this screen after 3 minutes of inactivity. In case the system detects a fault, the display shows a flashing fault message (see section *Fault messages*, page 72).

9.1.2 View transmitter status

The first screen of the Main menu gives information about the present status of the transmitter. The screens shows the name of the transmitter (1st line) and the present transmission mode (2nd line). See examples below. See section *Set transmission (4A)*, page 52 to change the transmission mode.

Transmitter
10 Channels DCN

Transmitter
Aux to All

Transmitter
Standby

Transmitter is transmitting 10 channels from DCN.

Transmitter is transmitting the Aux inputs on all channels.

Transmitter is in Standby mode (not transmitting).

Menu Item	Option (read only)	Description
Transmitter Status	Name	The first line shows the user defined name of the transmitter (see section <i>Choose transmitter name (4O)</i> , page 58).
	Mode:	The second line shows the actual transmission mode:
	- nn Channels	Audio signals are distributed on nn channels.
	- Aux to All	The signal on the Aux. inputs is distributed on all channels.
	- nn Ch. Test	The test signals are distributed on nn channels.
	- Slave	The transmitter operates in slave-mode: the radiator signal on the slave input is looped-through to all radiator outputs.
	- Standby	The transmitter is in stand by mode.
	- Emergency Call	An emergency signal from the Aux. inputs is distributed to all channels.
	DCN	The text 'DCN' is shown at the right side of the second line when a DCN Next Generation system is connected to the transmitter.

9.2 Integrus Radiators

A radiator consists of two IRED panels. Each IRED panel has an amber and a red indicator LED which show the status of the radiator panel

Red LED	Amber LED	Status
on	off	Standby mode
off	on	Transmitting
flashing	on	At switch-on: Initializing signal equalisation During operation: Temperature protection mode. See section <i>Faultfinding guide</i> , page 73.
on	on	IREC panel failure. See section <i>Faultfinding guide</i> , page 73.

**Notice!**

The indicator LEDs are positioned behind the semi-transparent cover and are only visible when ON.

**Notice!**

When in operation, the radiators may feel warm to the touch. This is normal, and does not indicate a radiator fault or malfunction.

9.3 Integrus Receivers

9.3.1

Normal operation

The receiver cannot operate when no headphone is connected.

1. Connect a headphone to the receiver.
2. Push the on/off button.
3. Push the volume button up/down to increase/decrease the volume.
4. Push the channel button up/down to select another channel. The highest channel number is automatically matched to the number of channels that has been set on the transmitter (see section *Set number of channels (4C)*, page 53).
5. Push the on/off button for more than 2 seconds, to put the receiver manually into standby mode.

The display of the receiver can show the following information:

- The channel number.
- A battery symbol when the batteries or the battery pack is almost empty.
- Antenna symbol when the signal reception is okay. No antenna symbol when no signal reception.

During short interruptions in the reception, the receiver mutes the headphones output.

In case standby mode is enabled, the receiver automatically switches to standby mode when no adequate IR signal is detected for more than 1 minute (e.g. when a delegate leaves the conference room). When the receiver is in standby mode, press the on button to return to normal operation.

**Notice!**

When the receiver is not used, disconnect the headphones. This ensures that the receiver is totally switched off and no energy is consumed from the batteries or the battery pack.

9.3.2 Storage of receiver

**Notice!**

When you put the receiver into storage for longer time, make sure that the following environmental conditions are met:

a humidity of less than 60%

a temperature of less than 25 °C.

9.4 Integrus Charging Units

Ensure that the charging unit is connected to the mains and that it is switched on. Place the receivers firmly in the charging compartments. The charging indicator on the power on/off button of all receivers should illuminate. The indicator shows the charging status of each receiver:

Indicator color	Charging status
Green	Charging completed.
Red	Charging in progress.
Red blinking	Error status. See section <i>Faultfinding guide, page 73</i> , Trouble-shooting.
Off	Charger switched off or receiver not properly inserted.

Notice!

These charging units are only intended to charge LBB 4540 receivers with a LBB 4550/10 battery pack. You cannot charge other receiver types with the LBB 4560 charging units, nor can you use other charging units to charge LBB 4540 receivers.



It is preferred to switch on the charging unit before inserting the receivers. Receivers can be inserted or removed without damage while the charging unit is switched on.

Charge the battery pack to full capacity before using them for the first time.

The charger always applies fast charge during the first 10 minutes after inserting a receiver. Inserting the receiver multiple times with a fully charged battery pack should therefore be avoided, as this will damage the battery pack.

Continuously charging the receiver will not damage the receiver or battery pack. Receivers can therefore safely be left in their charging positions when they are not used.

10 Troubleshooting

10.1 Fault messages

When the system detects a failure for the first time, a flashing fault message pops-up on any menu screen:



The fault status of the radiators can be seen in the second screen of the transmitter main menu:

Menu Item	Value (read only)	Description
1 Fault Status	Fault:	
	- No Faults	The connected radiators function without problems.
	- Radiator Fault	One of the connected radiators is not functioning properly.
	- No Radiators	No radiators are connected to the transmitter
	- No Network	When the Network Mode (see section <i>Set network mode (4B)</i> , page 52) is Enabled, this fault is shown when there is a fault in the optical network.
	- Network Error	When the Network Mode (see section <i>Set network mode (4B)</i> , page 52) is Standalone, this fault is shown when there is a fault in the optical network. This message usually occurs when the Network Mode (see section <i>Set network mode (4B)</i> , page 52) is Standalone, and a DCN Next Generation CCU is connected to the transmitter.

Push the menu button to remove the fault message from the screen and to go back to the menu screen that was visible before the fault message popped-up. The flashing message will also disappear when the fault has been resolved. See next section how to resolve this problem.

10.2 Faultfinding guide

In this section a simple fault-finding guide is given. This is intended to be used to remedy the consequences of incorrect installation. If more serious faults or problems arise the installer should contact a qualified technician.

Problem	Actions
Transmitter display does not light up:	<ul style="list-style-type: none"> – Check that the mains supply to the transmitter is connected and that the transmitter is switched on.
Transmitter indicates “no radiators”:	<ul style="list-style-type: none"> – Ensure that connections to all radiators have been made correctly and that each radiator’s mains supply is connected and switched on.
Transmitter indicates “radiator fault”:	<ul style="list-style-type: none"> – Ensure that connections to all radiators have been made correctly and that each radiator’s mains supply is connected and switched on. – Examine the radiator LEDs.
Transmitter indicates “no network”:	<ul style="list-style-type: none"> – Check that the optical network is connected correctly. – Check that the control unit of the DCN Next Generation conference system is switched on or disable the network mode (menu 4B).
Transmitter indicates “network error”:	<ul style="list-style-type: none"> – Enable the network mode (menu 4B) or disconnect the transmitter from the optical network.
Transmitter does not synchronize automatically to the maximum number of channels in DCN:	<ul style="list-style-type: none"> – Ensure that the number of channels is set to automatic (using menu item 4B).
Emergency contact on the transmitter does not work:	<ul style="list-style-type: none"> – Check that the emergency contact is connected correctly. – Check that the audio is connected according to the selected auxiliary input mode (menu 4I). – Check, when the network mode of the transmitter is enabled, that the transmitter can connect to the optical network.
Red LED flashes and amber LED is on of one or both IRED panels of a radiator:	<ul style="list-style-type: none"> – IRED panel is in temperature protection mode. Check that the natural airflow around that radiator is not obstructed. If not so, replace the radiator.
Both red LED and amber LED are on of one or both IRED panels of a radiator:	<ul style="list-style-type: none"> – IRED panel malfunctions and the radiator should be replaced.

Problem	Actions
Infrared receiver fails to function properly:	<ul style="list-style-type: none"> – If disposable batteries are used, check whether the batteries have sufficient capacity and whether they are inserted with the correct polarity. – If a battery pack is used, ensure that the battery pack is fully charged. – Ensure that the headphone is connected properly. – Switch the receiver on and check whether the display indicates a channel. – Ensure that the receiver picks up sufficient IR signal and check whether the antenna symbol becomes visible. – Enable the mini radiator (menu 4M) and check the receiver by holding it in front of the mini radiator of the transmitter. – Ensure that the volume control is turned up. – Set the transmitter in test mode and check whether the test tone is audible on the receiver. – If the test tone is not audible, do the same test with other receivers. If all receivers do not work properly at that spot, check the coverage of the system (see <i>Test the coverage area</i>, page 67).
The charging indicator LED on the receiver is blinking:	<ul style="list-style-type: none"> – Check that the charging unit is used under the specified working conditions (see technical data). – Check that the receiver contains a battery pack which is connected correctly. – Ensure that the receiver is at room temperature and re-insert the receiver in the charging unit. – If the charging indicator starts blinking again, replace the battery pack and check whether the problem is resolved.
Receiver discharges very quickly:	<ul style="list-style-type: none"> – Replace the battery pack and check whether the problem is resolved.
Bad coverage:	<ul style="list-style-type: none"> – Do the tests as described in <i>Test the coverage area</i>, page 67.

10.3 Service requests

In case you cannot be solved the problem, submit a service request or failure report. Include version information in service requests and failure reports. For the transmitter, version information can be found in the Enquiry sub-menu (3).

Menu Item	Value (read only)	Description
3A Serial Number	e.g. 19.0.00001	Shows the serial number of the transmitter board.
3B HW Version	e.g. 01.00	Shows the version number of the transmitter board.
3C FPGA Version	e.g. 2.00.00	Shows the version number of the FPGA software of the transmitter board.
3D FW Version	e.g. 1.00.0001	Shows the version number of the transmitter firmware.

11 Maintenance

The Integrus system requires a few maintenance operations, which are given in the following table.

Integrus component	Interval	Check
Rechargeable battery pack	Regularly after three years.	The batteries are not leaking. Replace the battery if there is any sign of leakage or corrosion.
	Five years.	Replace the battery pack. Ensure that only the battery pack LBB 4550/10 is used.
Radiator	Once a year	Inspect the installation, if radiators are suspended. If any sign of weakness or damage is detected, remedial action should be taken immediately.

12 Technical Data

12.1 Electrical Data

12.1.1 Overall system characteristics

Transmission Characteristics

IR transmission wavelength	870 nm
Modulation frequency	Carriers 0 to 5: 2 to 6 MHz, according to IEC 61603 part 7 Carriers 6 and 7: up to 8 MHz
Protocol and modulation	DQPSK, according to IEC technique 61603 part 7

System Audio Performance

(Measured from the audio input of an INT-TX range transmitter to the headphone output of an LBB 4540 range receiver.)

Audio frequency response	20 Hz to 10 kHz (-3 dB) at Standard Quality 20 Hz to 20 kHz (-3 dB) at Premium Quality
Total harmonic distortion at 1 kHz	< 0.05%
Crosstalk attenuation at 1 kHz	> 80 dB
Dynamic range	> 80 dB
Weighted signal-to-noise ratio	> 80 dB(A)

Cabling and System Limits

Cable type	75 Ohm RG59
Maximum number of radiators	30 per HF output
Maximum cable length	900 m (2,970 feet) per HF output.

12.1.2 Transmitters and Modules

Infrared Transmitters

Mains voltage	100-240 Vac, 50-60 Hz
Power consumption	
operating, maximum	55 W
standby	29 W
Asymmetrical audio inputs	+3 dBV nominal, +6 dBV maximum (± 6 dB) +15 dBV nominal, +18 dBV maximum (± 6 dB)
Symmetrical audio inputs	+6 to +18 dBV nominal
Emergency switch connector	Emergency control input
Headphone output	32 ohm to 2 kohm
HF input	Nominal 1 Vpp, minimum 10 mVpp, 75 ohm
HF output	1 Vpp, 6 VDC, 75 ohm

Integrus Audio Input and Interpreters module

Audio input level with AGC	-16.5 dBV (150 mVeff) to +3.5 dBV (1500 mVeff)
Audio input level without AGC	-4.4 dBV (600 mVeff)
Asymmetric input impedance	≥ 10 kohm
DC input impedance	≥ 200 kohm

12.1.3**Radiators and Accessories****Medium and High Power Radiators**

Mains voltage	100-240 Vac, 50-60 Hz
Power consumption	
LBB 4511, operating	100 W
LBB 4511, standby	8 W
LBB 4512, operating	180 W
LBB 4512, standby	10 W
Number of IREDs	
LBB 4511	260
LBB 4512	480
Total optical peak intensity	
LBB 4511	12 W/sr
LBB 4512	24 W/sr
Angle of half intensity	± 22°
HF input	Nominal 1 Vpp, minimum 10 mVpp

12.1.4**Receivers, Battery Packs and Charging Units****Pocket Receivers**

IR irradiance level	4 mW/m ² per carrier
Angle of half sensitivity	± 50°
Headphone output level at 2.4 V	450 mVrms (speech at maximum volume, 32 ohm headphone)
Headphone output frequency range	20 Hz to 20 kHz
Headphone output impedance	32 ohm to 2 kohm
Max. signal-to-noise ratio	80 dB(A)
Supply voltage	1.8 to 3.6 V, nominal 2.4 V
Power consumption at 2.4 V (battery voltage)	15 mA (speech at maximum volume, 32 ohm headphone)
Power consumption (standby)	< 1 mA

NiMH Battery Pack

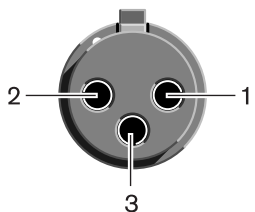
Voltage	2.4 V
Capacity	1100 mAh

Charging Units

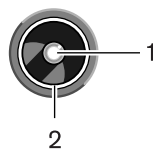
Mains voltage	100-240 Vac, 50-60 Hz
Power consumption	300 W (56 receivers charging)
Power consumption (standby)	17 W (no receivers in the charging unit)

12.1.5**Cables and connectors****Mains cables**

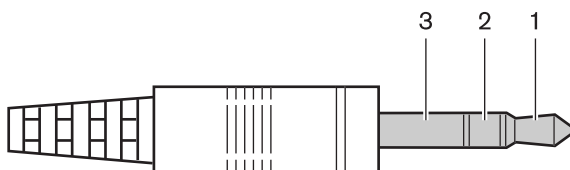
Blue	Neutral
Brown	Live
Green/Yellow	Ground

Audio cables: 3-pole XLR connector (female)

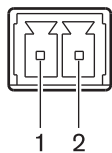
Pin 1	Ground
Pin 2	Signal +
Pin 3	Signal -

Audio cables: Chinch connector (male)

Pin1	Signal +
Pin 2	Signal -

Earphones: 3.5 mm Jack plug

Tip (1)	Signal left
Ring (2)	Signal Right
Sleeve (3)	Electrical ground/screen

Emergency switch: Terminal block

Connect the emergency switch to pin 1 and 2.

12.2 Mechanical Data

12.2.1 Transmitters and Modules

Infra Red Transmitters

Dimensions (H x W x D)	
for tabletop use, with feet	92 x 440 x 410 mm (3.6 x 17.3 x 16.1 in)
for 19" rack use, with brackets	88 x 483 x 410 mm (3.5 x 19 x 16.1 in)
in front of brackets	40 mm (1.6 in)
behind brackets	370 mm (14.6 in)
Weight without brackets, with feet	6.8 kg (15.0 lb)
Mounting	Brackets for 19" rack mounting or fixing to a tabletop Detachable feet for free-standing on a tabletop
Color	Charcoal (PH 10736) with silver

Integrus audio input and interpreters module

Mounting	Front panel is removed when used with INT-TX Integrus Transmitter
Dimensions (H x W x D) without front panel	100 x 26 x 231 mm (39 x 10 x 91 in)
Weight without front panel	132 g (0.29 lb)

12.2.2 Radiators and Accessories

Radiators and Accessories

Mounting	<ul style="list-style-type: none"> – Suspension bracket for direct ceiling mounting. – Mounting plates for floor stands with M10 and 1/2 in Whitworth thread. – Optional wall mounting bracket (LBB 3414/00) available. – Safety eye.
Dimensions (H x W x D)	
LBB 4511 without bracket	200 x 500 x 175 mm (7.9 x 19.7 x 6.9 in)
LBB 4512 without bracket	300 x 500 x 175 mm (11.0 x 19.7 x 6.9 in)
Radiator angle	

floor-stand mounting	0, 15, and 30°
wall/ceiling mounting	0, 15, 30, 45, 60, 75 and 90°
Weight	
LBB 4511 without bracket	6.8 kg (15 lb)
LBB 4511 with bracket	7.6 kg (17 lb)
LBB 4512 without bracket	9.5 kg (21 lb)
LBB 4512 with bracket	10.3 kg (23 lb)
Color	Bronze

Wall Mounting Bracket

Dimensions (H x W x D)	200 x 280 x 160 mm (7.9 x 11.0 x 6.3 in)
Weight	1.8 kg (4.0 lb)
Color	Quartz grey

12.2.3

Receivers, Battery Packs and Charging Units

Pocket Receivers

Dimensions (H x W x D)	155 x 45 x 30 mm (6.1 x 1.8 x 1.2 in)
Weight	
excluding battery	75 g (0.16 lb)
including battery	125 g (0.27 lb)
Color	Charcoal with silver

NiMH Battery Pack

Dimensions (H x W x D)	14 x 28 x 50 mm (0.6 x 1.1 x 1.9 in)
Weight	50 g (0.11 lb)

Charging Units

Mounting	
LBB 4560/50	Screws and plugs for wall mounting included
Dimensions (H x W x D)	
LBB 4560/00	230 x 690 x 530 mm (9 x 27 x 21 in)
LBB 4560/50	130 x 680 x 520 mm (5 x 27 x 20 in)
Weight excl. receivers	
LBB 4560/00	15.5 kg (34 lb)

LBB 4560/50	11.2 kg (25 lb)
Weight incl. 56 receivers	
LBB 4560/00	22.3 kg (49 lb)
LBB 4560/50	18.0 kg (40 lb)
Color	Charcoal with grey

12.3

Ambient Conditions

12.3.1

Overall system conditions

Working conditions	Fixed/stationary/transportable
Temperature range:	
- transport	-40 to +70 °C (-40 to 158 °F)
- operating and storage	LBB 4560 and LBB 4540 range: +5 to +35 °C (41 to 113 °F) LBB 4511/00 and LBB 4512/00 radiators: +5 to +45 °C (41 to 122 °F) INT-TX range: +5 to +55 °C (41 to 131 °F)
Relative humidity:	
- transport	5 to 95%
- operating and storage	15 to 90%
Safety	LBB 4540 range, LBB 4560/00, LBB 4560/50: EN60065/CAN/CSA-C22.2 60065 (Canada) / UL60065 (USA) LBB 4511/00, LBB 4512/00: EN60065/CAN/CSA-C22.2 60065 (Canada) / UL1419 (USA) INT-TX range: EN60065
EMC emission	According to harmonized standard EN 55103-1 and FCC rules part 15, complying with the limits for a class A digital devices
EMC immunity	According to harmonized standard EN 55103-2
EMC approvals	Affixed with the CE mark
ESD	According to harmonized standard EN 55103-2
Mains harmonics	According to harmonized standard EN 55103-1
Environmental requirements	Contains no banned substances as specified in RoHS Directive.

12.4 Rules and Standards

12.4.1 Overall system conformance

- Conforms to IEC 60914, the international standard for conference systems
- Conforms to IEC 61603 part 7, the international standard for digital infrared transmission of audio signals for conference and similar applications

12.5 Guaranteed rectangular footprints

12.5.1 Metric values of radiators with hardware version higher than 2.00

			LBB 4511/00 at full power				LBB 4512/00 at full power			
Nr.	H	a	A	L	W	X	A	L	W	X
1	2,5	0	814	37	22	8,5	1643	53	31	11,5
	5	15	714	34	21	8	1440	48	30	10,5
		30	560	28	20	5	1026	38	27	6,5
		45	340	20	17	2	598	26	23	3
		60	240	16	15	-0,5	380	20	19	0
		90	169	13	13	-6,5	196	14	14	-7
	10	15	770	35	22	10	1519	49	31	12,5
		30	651	31	21	6	1189	41	29	8
		45	480	24	20	2,5	837	31	27	3
		60	380	20	19	-1,5	600	25	24	-1
		90	324	18	18	-9	441	21	21	-10,5
	20	30	609	29	21	12	1364	44	31	11
		45	594	27	22	6	1140	38	30	4,5
		60	504	24	21	0,5	899	31	29	-1,5
		90	441	21	21	-10,5	784	28	28	-14
2	2,5	15	360	24	15	5	714	34	21	7
	5	15	375	25	15	6	714	34	21	8
		30	294	21	14	4	560	28	20	5
		45	195	15	12	1,5	340	20	17	2
		60	156	13	12	-1	240	16	15	-0,5
		90	121	11	11	-5,5	169	13	13	-6,5
	10	30	330	22	15	5,5	651	31	21	6
		45	285	19	15	2,5	480	24	20	2,5
		60	224	16	14	-1	380	20	19	-1,5
		90	196	14	14	-7	324	18	18	-9
	20	60	255	17	15	2,5	504	24	21	0,5
		90	225	15	15	-7,5	441	21	21	-10,5
4	2,5	15	187	17	11	4	360	24	15	5
	5	15	187	17	11	5	375	25	15	6

			LBB 4511/00 at full power				LBB 4512/00 at full power			
Nr.	H	a	A	L	W	X	A	L	W	X
		30	165	15	11	3,5	294	21	14	4
		45	120	12	10	1,5	195	15	13	1,5
		60	90	10	9	-0,5	156	13	12	-1
		90	81	9	9	-4,5	121	11	11	-5,5
	10	45	154	14	11	3	285	19	15	2,5
		60	132	12	11	0	224	16	14	-1
		90	100	10	10	-5	196	14	14	-7
	20	90	100	10	10	-5	225	15	15	-7,5
8	2,5	15	96	12	8	3	187	17	11	4
	5	15	84	12	7	4,5	187	17	11	5
		30	88	11	8	3	165	15	11	3,5
		45	63	9	7	1,5	120	12	10	1,5
		60	56	8	7	-0,5	90	10	9	-0,5
		90	49	7	7	-3,5	81	9	9	-4,5
	10	60	64	8	8	1,5	132	12	11	0
		90	64	8	8	-4	100	10	10	-5

(The mounting height is the distance from the reception plane and not from the floor).

Nr = Number of carriers

A= area [m²]

W= width [m]

H = mounting height [m]

L= length[m]

X= offset [m]

a = mounting angle [degrees]

12.5.2 Imperial values of radiators with hardware version higher than 2.00

			LBB 4511/00 at full power				LBB 4512/00 at full power			
Nr.	H	a	A	L	W	X	A	L	W	X
1	8	0	8712	121	72	28	17748	174	102	38
	16	15	7728	112	69	26	15386	157	98	34
		30	6072	92	66	16	11125	125	89	21
		45	3696	66	56	7	6375	85	75	10
		60	2548	52	49	-2	4092	66	62	0
		90	1849	43	43	-21	2116	46	46	-23
	33	15	8280	115	72	33	16422	161	102	41
		30	7038	102	69	20	12825	135	95	26
		45	5214	79	66	8	9078	102	89	10
		60	4092	66	62	-5	6478	82	79	-3
		90	3481	59	59	-30	4761	69	69	-34
	66	30	6555	95	69	39	14688	144	102	36
		45	6408	89	72	20	12250	125	98	15
		60	5451	79	69	2	9690	102	95	-5
		90	4761	69	69	-34	8464	92	92	-46
2	8	15	3871	79	49	16	7728	112	69	23
	16	15	4018	82	49	20	7728	112	69	26
		30	3174	69	46	13	6072	92	66	16
		45	1911	49	39	5	3696	66	56	7
		60	1677	43	39	-3	2548	52	49	-2
		90	1296	36	36	-18	1849	43	43	-21
	33	30	3528	72	49	18	7038	102	69	20
		45	3038	62	49	8	5214	79	66	8
		60	2392	52	46	-3	4092	66	62	-5
		90	2116	46	46	-23	3481	59	59	-30
	66	60	2744	56	49	8	5451	79	69	2
		90	2401	49	49	-25	4761	69	69	-34
4	8	15	2016	56	36	13	3871	79	49	16
	16	15	2016	56	36	16	4018	82	49	20
		30	1764	49	36	11	3174	69	46	13

			LBB 4511/00 at full power				LBB 4512/00 at full power			
Nr.	H	a	A	L	W	X	A	L	W	X
		45	1287	39	33	5	2107	49	43	5
		60	990	33	30	-2	1677	43	39	-3
		90	900	30	30	-15	1296	36	36	-18
	33	45	1656	46	36	10	3038	62	49	8
		60	1404	39	36	0	2392	52	46	-3
		90	1089	33	33	-16	2116	46	46	-23
	66	90	1089	33	33	-16	2401	49	49	-25
8	8	15	1014	39	26	10	2016	56	36	13
	16	15	897	39	23	15	2016	56	36	16
		30	936	36	26	10	1764	49	36	11
		45	690	30	23	5	1287	39	33	5
		60	598	26	23	-2	990	33	30	-2
		90	529	23	23	-11	900	30	30	-15
	33	60	676	26	26	5	1404	39	36	0
		90	676	26	26	-13	1089	33	33	-16

(The mounting height is the distance from the reception plane and not from the floor).

Nr = Number of carriers

A= area [ft²]

W= width [ft]

H = mounting height [ft]

L= length [ft]

X= offset [ft]

a = mounting angle [degrees]

12.5.3 Metric values of radiators with hardware version lower than 2.00.

			LBB 4511/00 at full power				LBB 4512/00 at full power			
Nr.	H	a	A	L	W	X	A	L	W	X
1	2.5		627	33	19	7	1269	47	27	10
	5	15	620	31	20	7	1196	46	26	8
		30	468	26	18	4	816	34	24	6
		45	288	18	16	2	480	24	20	2
		60	196	14	14	0	324	18	18	0
		90	144	12	12	-6	196	14	14	-7
	10	15	589	31	19	9	1288	46	28	10
		30	551	29	19	5	988	38	26	6
		45	414	23	18	2	672	28	24	2
		60	306	18	17	-1	506	23	22	-1
		90	256	16	16	-8	400	20	20	-10
	20	30	408	24	17	13	1080	40	27	11
		45	368	23	16	7	945	35	27	4
		60	418	22	19	1	754	29	26	-1
		90	324	18	18	-9	676	26	26	-13
2	2.5	15	308	22	14	4	576	32	18	6
	5	15	322	23	14	5	620	31	20	7
		30	247	19	13	3	468	26	18	4
		45	168	14	12	1	288	18	16	2
		60	132	12	11	-1	196	14	14	0
		90	100	10	10	-5	144	12	12	-6
	10	30	266	19	14	6	551	29	19	5
		45	234	18	13	2	414	23	18	2
		60	195	15	13	-1	306	18	17	-1
		90	144	12	12	-6	256	16	16	-8
	20	60	195	15	13	3	418	22	19	1
		90	196	14	14	-7	324	18	18	-9
4	2.5	15	160	16	10	3	308	22	14	4
	5	15	144	16	9	4	322	23	14	5
		30	140	14	10	3	247	19	13	3

			LBB 4511/00 at full power				LBB 4512/00 at full power			
Nr.	H	a	A	L	W	X	A	L	W	X
		45	99	11	9	1	168	14	12	1
		60	90	10	9	-1	132	12	11	-1
		90	64	8	8	-4	100	10	10	-5
	10	45	120	12	10	3	234	18	13	2
		60	108	12	9	0	195	15	13	-1
		90	100	10	10	-5	144	12	12	-6
	20	90	64	8	8	-4	196	14	14	-7
8	2.5	15	84	12	7	2	160	16	10	3
	5	15	60	10	6	4	144	16	9	4
		30	70	10	7	3	140	14	10	3
		45	63	9	7	1	99	11	9	1
		60	49	7	7	0	90	10	9	-1
		90	36	6	6	-3	64	8	8	-4
	10	60	49	7	7	2	108	12	9	0
		90	49	7	7	-3.5	100	10	10	-5

(The mounting height is the distance from the reception plane and not from the floor).

Nr = Number of carriers

A= area [m²]

W= width [m]

H = mounting height [m]

L= length[m]

X= offset [m]

a = mounting angle [degrees]

12.5.4 Imperial values of radiators with hardware version lower than 2.00.

			LBB 4511/00 at full power				LBB 4512/00 at full power			
Nr.	H	a	A	L	W	X	A	L	W	X
1	8		6696	108	62	23	13706	154	89	33
	16	15	6732	102	66	23	12835	151	85	26
		30	5015	85	59	13	8848	112	79	20
		45	3068	59	52	7	5214	79	66	7
		60	2116	46	46	0	3481	59	59	0
		90	1521	39	39	-20	2116	46	46	-23
	33	15	6324	102	62	30	13892	151	92	33
		30	5890	95	62	16	10625	125	85	20
		45	4425	75	59	7	7268	92	79	7
		60	3304	59	56	-3	5400	75	72	-3
		90	2704	52	52	-26	4356	66	66	-33
	66	30	4424	79	56	43	11659	131	89	36
		45	3900	75	52	23	10235	115	89	13
		60	4464	72	62	3	8075	95	85	-3
		90	3481	59	59	-30	7225	85	85	-43
2	8	15	3312	72	46	13	6195	105	59	20
	16	15	3450	75	46	16	6732	102	66	23
		30	2666	62	43	10	5015	85	59	13
		45	1794	46	39	3	3068	59	52	7
		60	1404	39	36	-3	2116	46	46	0
		90	1089	33	33	-16	1521	39	39	-20
	33	30	2852	62	46	20	5890	95	62	16
		45	2537	59	43	7	4425	75	59	7
		60	2107	49	43	-3	3304	59	56	-3
		90	1521	39	39	-20	2704	52	52	-26
	66	60	2107	49	43	10	4464	72	62	3
		90	2116	46	46	-23	3481	59	59	-30
4	8	15	1716	52	33	10	3312	72	46	13
	16	15	1560	52	30	13	3450	75	46	16
		30	1518	46	33	10	2666	62	43	10

			LBB 4511/00 at full power				LBB 4512/00 at full power			
Nr.	H	a	A	L	W	X	A	L	W	X
		45	1080	36	30	3	1794	46	39	3
		60	990	33	30	-3	1404	39	36	-3
		90	676	26	26	-13	1089	33	33	-16
	33	45	1287	39	33	10	2537	59	43	7
		60	1170	39	30		2107	49	43	-3
		90	1089	33	33	-16	1521	39	39	-20
	66	90	676	26	26	-13	2116	46	46	-23
8	8	15	897	39	23	7	1716	52	33	10
	16	15	660	33	20	13	1560	52	30	13
		30	759	33	23	10	1518	46	33	10
		45	690	30	23	3	1080	36	30	3
		60	529	23	23		990	33	30	-3
		90	400	20	20	-10	676	26	26	-13
	33	60	529	23	23	7	1170	39	30	0
		90	529	23	23	-11	1089	33	33	-16

(The mounting height is the distance from the reception plane and not from the floor).

Nr = Number of carriers

A= area [ft²]

W= width [ft]

H = mounting height [ft]

L= length[ft]

X= offset [ft]

a = mounting angle [degrees]

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