PANPHONICS
Audio Innovations

PANPHONICS PRIVACY SOLUTION™ DESIGNER'S GUIDE

PSDGEV1.0

An audio system approach for banks, pharmacies, insurance agencies, physician waiting areas, and other public places with confidentiality requirements.

TABLE OF CONTENTS

1. General

The purpose of this Designer's Guide is to advise the reader in the usage of the Panphonics Privacy Solution™ sound system. This document covers how to design, install, and use the system. It will also help parties in training others to use of the system.

1.1. Objective of the Privacy Solution™ system

The purpose of the system is to hinder and distract persons waiting to be served from hearing and understanding discussions between other customers and service staff. Privacy Solution is typically needed in service situations where discussions between the service clerks and customers are of a confidential nature. These type of service situations are typically found in waiting areas of banks, insurance companies, pharmacies, governmental offices, and health care waiting rooms.

When the ambient noise level in the service waiting area is too low, a person can possibly hear even a low level discussion a long distance away. Division walls and acoustical materials won't prevent the discussion from being overheard. The people who are waiting to be served can easily follow the line of discussions.

Panphonics Privacy Solution delivers directional audio to a defined area. Typically, the audio is intended to be heard only in the waiting area. Informative and easy listening media distracts the waiting customer and he starts to listen to the media. Hence, subconsciously and consciously he won't listen to the private information and discussions of the customer being served.

With the Panphonics Privacy Solution it is possible to reproduce over 90% of the frequencies important for the human speech intelligibility. The listener is served with informative content and his inclination towards "eavesdropping" is reduced. With the Panphonics Privacy Solution there is no need to use high sound pressure levels (volume). Because of the directional nature of the technology very little of the audio is carried outside the intended listening area. The overall noise level in the area/space will not increase with same level/intensity as it would with other sound solutions. This is an additional benefit of the system to employees.

1.2. Operating principle

The operating principle of the system is similar to the situation where a person in the shower and tries to communicate with someone in an other room. This usually results in very high volume shouting from the bathroom, although even a lower volume would have been sufficient. On the other hand, the person in the bathroom has difficulties hearing anything outside the bathroom. The Privacy Solution operating principle is the same. When there is audio media in the waiting area it is difficult for the people inside the area to hear and listen to what is happening outside the area.

It is important to choose media with interesting content that activates the waiting customers to listen to the media. The objective is to improve the performance without increasing cacophony and ambient noise level in the space.

The choice of media is easy; one can use any media that is interesting and easy to listen to but acceptable with the sound level and quality perspective. Typical media could be background music or radio programming.

Optimal Privacy Solution media does not contain high dynamic content where there is low volume sections and high volume sections in the same track (e.g. classical music). Compressed media content works exceptionally well because the dynamic content is artificially "flattened". Many

radio stations compress the media by default. Most of the information content of the media should be in the frequency range of 300-7000 Hz. This range is close to human speech frequencies. Lower or higher pitch frequency content does not deliver any noticeable additional results. Radio programs with advertisement content works fine in waiting room environments.

The system volume adjustment is an important issue. It is imperative to adjust the volume to a low enough level that is above the ambient noise level, yet loud enough to listen to hear. By following this simple rule, even discussions between the customers who are waiting are kept in a sufficiently low level. A person will subconsciously increase his speech volume when there is more than 48 dB ambient noise around him. On the other hand, people typically do not enter long discussions while waiting for the doctor or bank teller etc., and therefore it is possible to increase the media volume level even above the mentioned 48 dB should it be required.

2. Privacy Solution - usage situations

There are several types of customer service layouts and arrangements. Five basic variations from the audio reproduction perspective can be identified:

- Waiting areas
- Negotiation and service areas in open offices or areas with divisional walls
- Closed office negotiaton rooms and service rooms
- Back office work spaces in the open office environment
- Lobby areas

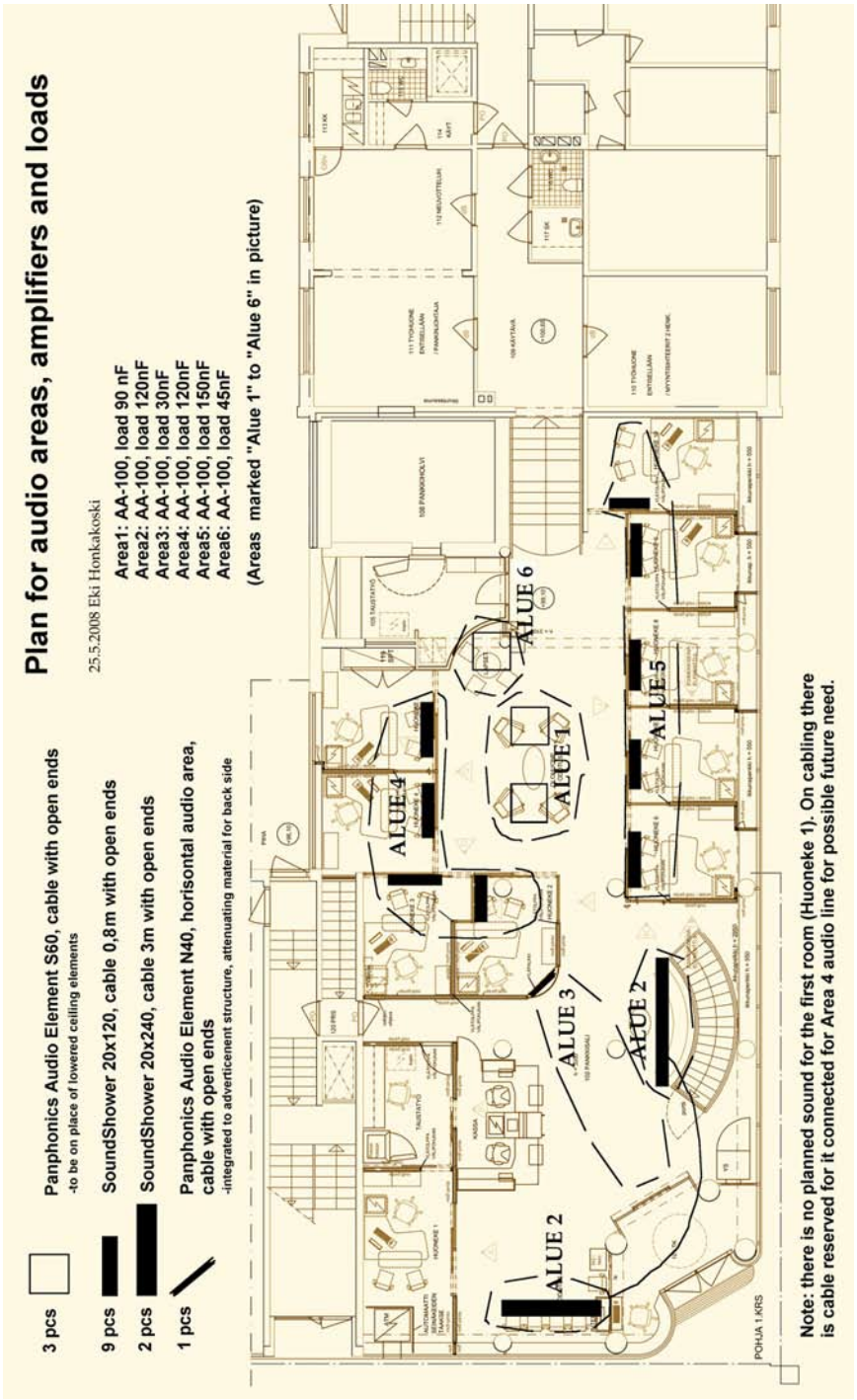

Figure 1. Typical bank layout with Panphonics Privacy Solution

The Figure 1 depicts a typical bank office layout with several different audio areas. Areas covered with Panphonics Privacy Solution are marked with dashed lines.

2.1. Waiting areas

Waiting areas are the areas where customers wait to be served. Typically these areas are open spaces and sometimes part of the office lobby. In these types of spaces sound travels easily, even over long distances.

The objective would be to make customers feel as positive as possible during the waiting time. Privacy Solution media should contain entertaining and interesting content such as music or talk radio shows. Sound volume is adjusted in a sufficient level so that the audio output remains clear. One should not have to concentrate to be able to follow the program. When a person is situated in an area equipped with the Privacy Solution the entertaining media works right way and distracts his ability to hear and understand what is happening around him. This is especially true concerning the discussions between the service persons and other customers who are being served at that time. The clarity of the Privacy Solution media is much higher than the clarity of the surrounding discussions. Therefore, someone who is waiting is subconsciously listening to Privacy Solution media rather than other customer's discussion. It is just simply easier to listen the Privacy Solution media than the other sounds around them.

Directed audio enables very low sound pressure levels (volume levels). This in turn means that the audio media does not spread around. With the Privacy Solution one can have limited audio areas without raising the volume level in general.

Special recommendations/considerations for this type of Privacy Solution situation:

- Entertainment value of the media. "Hook up" effect, so customers start to listen
- Moderate but correct sound volume level
- Right direction of the speaker system. The audio is directed to the proper area. This is important, since the volume attenuation can be remarkable, even inside one meter.

Figure 2. Privacy solution in bank branch waiting area. The speakers are hanging from the ceiling and are adjusted directly above the seating rows.

2.2. Negotiation and service areas (open offices or division walls)

Sometimes customer service areas are in wide open spaces. Various service stations are just tables which are time to time separated from each other by short office division walls. Discussions from the service points can easily be overheard by others in the surrounding space.

In open and partially open spaces the purpose of the Privacy Solution is to give background media to the people who are served. The media acts as a softening element in that surrounding and will subconsciously weaken the customers wish to listen to what is happening around them. It is important to remember that Privacy Solution only affects to the listeners will/ability to listen. It does not cancel any ambient noise in the space.

The volume adjustment of the system for the situation where the system is indented for the customers being served in the service booth is at sufficient level when it is difficult for a person to listen accurately what is said on the surrounding service points. On the other hand the volume level should not distract the actual service situation. It the volume level is too high, then customer might start to raise his voice, which is not desired for.

A proper media for this application is peaceful background music or neutral nature voices. Informative radio programs, news etc. distracts a person from the service situation and might not be the best choice. After all the intention is to support the service situation and not to hinder it.

Volume level should not be above the level where a person starts to raise his own voice. Typically the threshold value for this is about 48dB. When ambient noise level is above this value a person starts automatically adjust his speech volume according to the surrounding noise level and acoustics. The absolute ambient noise level (noise floor) varies along the day and it is affected by air conditioning, traffic, general noise level depending on the amount of people in the space etc.

All requirements above can be easily realized by Panphonics Privacy Solution.

Basic requirements:

- Low enough sound pressure level (volume level)
- Panphonics Sound Shower directional speakers to convey audio only to the areas where it is really needed and without increasing the overall noise floor in the space in question.
- The objective of the Privacy Solution media is to create atmosphere. It should not contain too much information content or constant changes in speech or media genre.

When installing the system the extreme accuracy of Panphonics Sound Shower products should be noted. The speakers should be directed towards the customers so that they will not disturb the service personnel working.

2.3. Fixed negotiation spaces and work stations

Closed environments such as negotiation rooms and office are not a problem concerning privacy. Discussions behind the closed doors cannot be heard outside.

Sometimes there is wish for background music for additional enjoyment. Directional audio enables efficient way of having the entertainment content just for one workstation. This minimizes the overall volume level in the space increasing employee comfort.

People perceive background music in various ways. Therefore it is recommended to include personal / room specific media control possibility. This way each person can adjust the volume level according to his personal preferences. Panphonics volume control component is designed so

that it prevents cutting off the media altogether. Hence, the system is always working as designed but still takes into account individual listening volume preferences.

Requirements for closed spaces:

- Entertaining media
- Adjustable volume control

2.4. Work stations in open office environment

Work stations in open office environment are for private working purposes and not for customer service. Here a Privacy Solution approach is useful when an individual worker is disturbed by the ambient noises / discussions etc. around him.

Workstations equipped with personal ambient audio media, such as Panphonics Privacy Solution increases productivity, helping to prevent distractive noises from other work spaces and does not affect other worker. It is an ideal solution when a company wants to satisfy its employees in open office.

The best result is achieved when the worker has full control of the media content they are listening to. Requirements for the open office work stations:

- Entertaining media
- Controllable volume
- Sharp directional audio footprint for a single person with Panphonics Sound Shower speakers

2.5. Public places / lobby areas

Sometimes directional audio comes in handy in public places and lobby areas. Audio areas can be installed in lobbies, corridors, foyers, or wherever it is needed. Typical use cases are directional audio for infoTV´s and network TV screens. With directional audio it is possible to define the audio footprint of a TV screen for a single sofa. Directional properties of the Panphonics Sound Shower products enables one to have several audio hot spots in same space.

Special applications could be long audio corridors or audio greetings near the doors. Audio beam from the Panphonics Sound Showers does not attenuate similarly like from the traditional speakers. Hence it is possible to have only one speaker to cover a long corridor. One can design an audio experience where ambient audio varies whether a person is moving in or out from the premises. One can also guide people efficiently with directional audio.

Figure 3. Privacy Solution in reception area

3. Privacy Solution™ system components

3.1. Panphonics Privacy Solution system and its components

Privacy Solution system is built by using Panphonics products and components. Typically the system design is passive, meaning that the amplifier is external and separate from the actual speaker unit.

As the amplifiers are supplied separately in the passive system they can easily be installed into separate technical room/cabinet where the media players are also located. This way it easy to drive different types of media to different office areas depending on the need and application.

Below is a short description of the system components. Some of the components also have a separate user guide for more detailed information.

3.2. Speakers

Panphonics Sound Shower speakers are designed to be installed either on ceilings or walls. Each speaker is equipped with the necessary wires and hooks for ceiling installation. The speaker's back plate also includes a VESA 100 standard bracket fitting with M4 threads for easy installation on the wall or LCD installation unit.

Due to the slim design of the speakers they blend easily into the building architecture and do not draw attention.

With the Privacy Solution system different types of media and different volume levels can easily be arranged depending on the application need and office configuration.

This solution also works very well in high ceiling environments because Sound Shower creates a clearly focused audio beam without spreading the sound. In addition, the sound does not attenuate as it does with normal speakers.

Panphonics Sound Shower passive speakers (SSHP) standard sizes:

- 60 x 60 cm
- 60 x 20 cm
- 100 x 20 cm
- 120 x 20 cm
- 180 x 20 cm
- 240 x 20 cm

Standard colors are gray, white, and black. Custom colors are available by request.

For example, with one SSHP120x20 speaker installed to the ceiling we can create approximately a 1.5 x 2 m audio footprint. Outside this area the sound pressure level drops very fast. This means that with one speaker we can create an audio footprint over 3—4 seats where clients are waiting to be served. If we need a larger audio footprint we either add additional speakers or increase the length of the speaker respectively.

Figure 4. Panphonics Privacy Solution speakers

3.3. Panphonics amplifiers

AA100e

The Panphonics AA100 amplifier is designed to be used with Sound Shower loudspeakers. It is optimized to drive the reactive load of the Panphonics Sound Shower Speakers. The amplifier is equipped with 24V DC power supply unit.

Technical Description, Electrical properties

Operation principle: Bridged monophonic (internal stereo to mono conversion)
Input impedance (audio IN): 10 k0hm (2kOhm with mono-plug)
Input voltage (audio IN): 50 mV – 2 V maximum, adjustable gain
Input connector (audio IN): 3,5 mm stereo jack, unbalanced
Frequency range: 400 Hz – 16 kHz
Maximum output signal level: 100 V AC
Maximum output signal power: 35 W
Bias voltage output level: 450 V DC
Output connector (loudspeaker): 9pin D sub (DB9)
pin 3: BIAS voltage DC; pin 6: AUDIO positive AC; pin 9: AUDIO negative AC
Power output for external device: 5 V / 100 mA DC, USB A type connector
Automatic volume control relative to changes in ambient noise level (can be disabled)
Virtual bass feature (can be disabled)
Power indicator led (green), Audio output overdrive (clip) indicator led (red)
Power supply: External 24 V DC power supply.
Power supply connector diameter 2,1 mm / 5,5 mm (center / +out). **Only use power units supplied by Panphonics.**
Physical dimensions: 150 x 112 x 30 (length x width x height, mm)
Customs codes: HScode 851840, CNcode 8518.40.8

Figure 5. A100e external amplifier front and back plates

AA160 (Available Autumn 2009)

The AA160 is simple power amplifier designed for driving Panphonics Sound Shower speakers.

Technical specification:

Output Frequency Characteristic of AA160 power stage
200 – 16kHz (160 V @ 135 nF, 0dB).
Rated output: performing 160 V rms against 135 nF capacitive load
Bias output: maximum of +450V
Total Harmonic Distortion: not over 0.05 % at any frequency at 75% rated output
S/N Ratio: minimum 70 dB (400 Hz~30 kHz BPF)
Residual Noise: Minimum 100 mV (400 Hz~30 kHz BPF)
Standby current: not over 200 mA
Ambient Temperature Range: 0°C - 40°C
Outer surface maximum temperature: according IEC 60065
IEC 60065 Audio, video and similar apparatus – Safety requirement
Input sensitivity of input module: 200mV minimum, 10kOhm

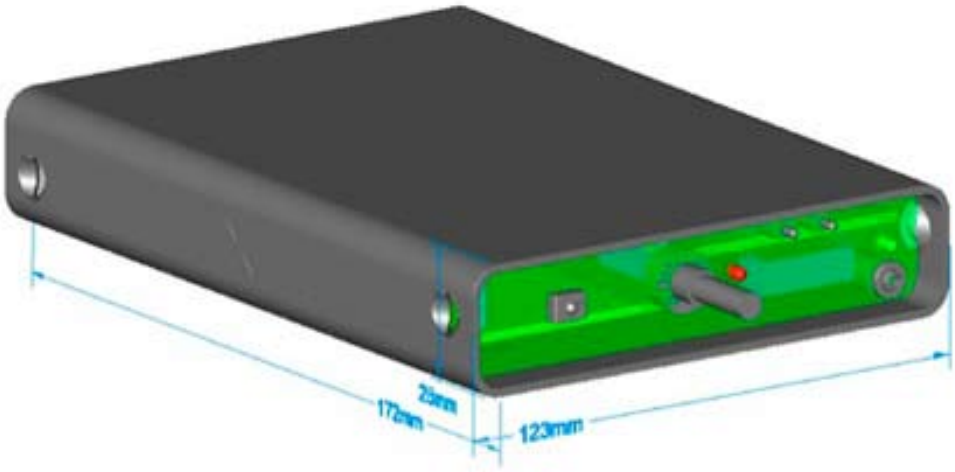

Figure 6. AA160 Amplifier

3.4. Other components (cables, volume controls, etc.)

Cables in fixed installations

In all fixed installations a 3-wire double insulated AWG 24-20, with resistant of 500V class insulation can be used. When driving media with low sound levels and using a separate volume control, a 300V class insulated cables might also be used. In double insulation each wire has its own insulation and individual wires are attached to a common insulation core.

Most manufacturers signal and data cables fulfill these requirements.

Examples of suitable cables are:

- LIYY, 3CORE, 0.25MM, 50M, Farnell order code (2009): 1204317
- DINFLEX Y 3 x 0,25mm^2
- ALPHA WIRE 1896C, CABLE, UL2509, 20AWG, 3 CORE, 30.5M, Farnell order code (2009): 1619539
- ALPHA WIRE 1173C100, CABLE, 22AWG, 3CORE, 30.5M, Farnell order code (2009): 1235591
- ALPHA WIRE 1771 BLACK 100 FT, CABLE, 23AWG, SHLD, 2CORE, 30,5M, Farnell order code (2009): 1302750
- NEXANS SMA 03X0.22 CABLE, SMA, 3C, 0.22MM, 100M, CABLE, SMA, 3C, 0.22MM, 100M, Farnell order code: 4119447
- HARTING 09456000145 ETHERNET CABLE, OUTDOOR, 50M, Harting part number: 09456000145
- ETHERNET CABLE, OUTDOOR, 50M, Farnell order code: 1161648

Installations are done with typical connector boxes and terminals that have been accepted to be used in electronic installations. All installations should be done by a skilled professionally only.

Panphonics own extension cables - semi fixed installation

Small systems or extensions can easily be done with Panphonics in extensions cables (EC300) and Y-cables (YCAB1), which are equipped with D-connectors designed to be used with Panphonics amplifier and speakers

A Y-cable (YCAB1) can be used to drive the signal from amplifier to two separate speakers or two different directions. An extension cable (EC300) can be used to make signal cables longer when necessary. Both cables are suitable to be used with Panphonics amplifiers and speakers.

Volume level control (Latt9db)

Amplifier level control adjusts the volume levels of a speaker or set of speakers Therefore all speakers attached to the same line have same volume level. Sometimes it is necessary to fine tune speakers on the same line to different volume level or temporarily reduce the volume level of one speaker/speakers locally. This can be achieved by using Panphonics Level Attenuator 9dB (LAtt9dB) regulator. This control device can be used both with AA100e and AA160 amplifiers and also with the bias generator.

The circuit board is installed into a Strömfors Arctica box for architectural installations. In the box there are internal connector terminal. On the top of the box there is a knob for the potentiometer regulator.

Other components

Sometimes speakers can be driven with a third party amplifier. It is the responsibility of the installer to verify the amplifier's applicability with Sound Shower speakers.

Consideration should be taken to the amplifier's capability of driving capacitive loads and very low impedance loads. Typically, D-class amplifiers are found to be suitable.

An additional concern with using third-party amplifiers is that they usually do not have the necessary

bias voltage. The require bias voltage can be created by using Panphonics bias generator (BG) when using a third party amplifier. BG is connected to amplifier output feed, which is connected to Sound Shower directional speakers with Panphonics extension cables (EC300).

BG can be used either passive with 3—100 V audio voltage feed or active with its own power supply. In active mode the bias voltage is independent of the audio signal. This is recommend for example when system is equipped with LAtt-9dB attenuator. BG is in its own installation box and all connections are inside the box. On the side of the box there is a connector for an outside PSU, if BG is to be used in active mode. The BG box comes with flanges, surface mounts, connector terminals inside box, and places for cable ties to provide cable stress relief.

Bias Generator Technical Specifications:

Audio In: 3-100V, connector terminal (speaker)
Bias Out: 420VDC, 20 mA max, terminal
Power In: 4-24V AC or 9-24V DC center+
Power In Connector: DC Power 2.1mm PK10

Optional remote volume level control potentiometer feature: separate terminals inside box, wire length/loop 25m, ordinary phone cable is usable, potentiometer value 50k0hm (not included).

Please read manuals and instructions carefully. Panphonics may only give advise for third party amplifier selection. If uncertain please use Panphonics amplifiers, where bias voltage is already built-in.

4. System design

4.1. Ceiling installation

For waiting areas the natural way of creating an audio spot is to install Sound Shower speakers on the ceiling structure. This can easily be done by utilizing the hanging kit included in the Sound Shower Speaker package.

Figure 7. Privacy Solutions in banks waiting area integrated with digital signage system

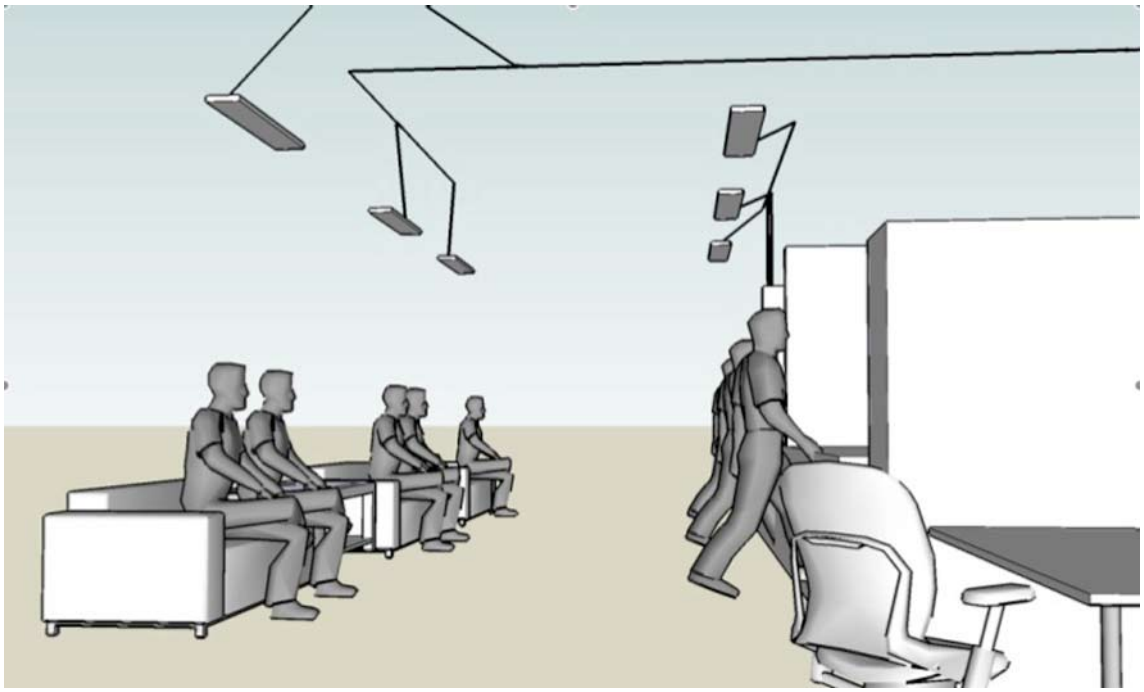

Figure 8. Typical Privacy Solution ceiling installation in waiting/service area

4.2. Wall installation

Panphonics Sound Shower speakers are equipped with VESA 100 standard bracket fittings with M4 threads. In this way commercial brackets like LCD monitor brackets can be used. Use M4 bolts that does not exceed the thickness of Sound Shower and bolt length less that 25 mm.

Figure 9. VESA 100 bracket on the back of Sound Shower speaker

Figure 10. Panphonics Sound Shower speaker installed with digital signage

4.3. Attaching a media source to AA100e and AA160 amplifiers

Any normal media source can be used (e.g. radio, MP3, DVD/CD-player, media player). The sound source is attached directly to the AA100e amplifier with a 3.5 mm stereo plug.

The amplifiers' output is connected to the Sound Shower speakers either directly or using Panphonics extensions and y-cables.

Figure 11. Y-cable with D-connector

Figure 12. Extensions cable with D-connector

One AA100E amplifier can power a maximum of four Sound Shower passive speakers when normal 40—65 db volume levels are used. In full power situations (e.g. 83db) a maximum of two speakers

should be connected to a single AA100E.

One AA160 amplifier can power a maximum of 8-10 Sound Shower passive speakers.

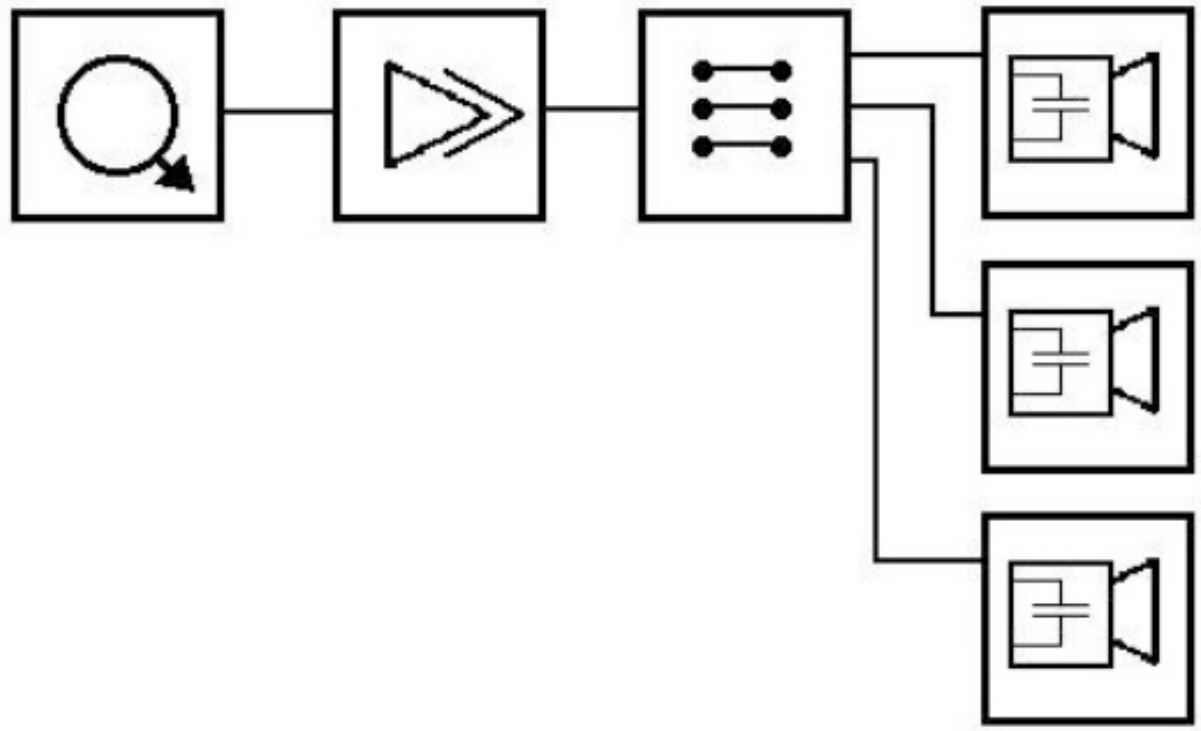

Figure 13. Privacy Solution system installation

If there is a requirement for several audio areas with different media content then each feed requires its own audio source and amplifier. If, for example, the waiting areas are supplied with radio and open service areas with background music, both require separate media sources, amplifiers, and speaker cable lines.

Sound Shower speakers and ordinary dynamic speakers cannot be attached to same line as they do not comply electrically. Both systems have to be driven separately with separate amplifiers and cables.

If the whole area is to be driven with same media sometimes there is a need to have different volume levels in different areas. This can be achieved either by a separate amplifier for each area or using the Panphonics LAtt-9dB attenuator.

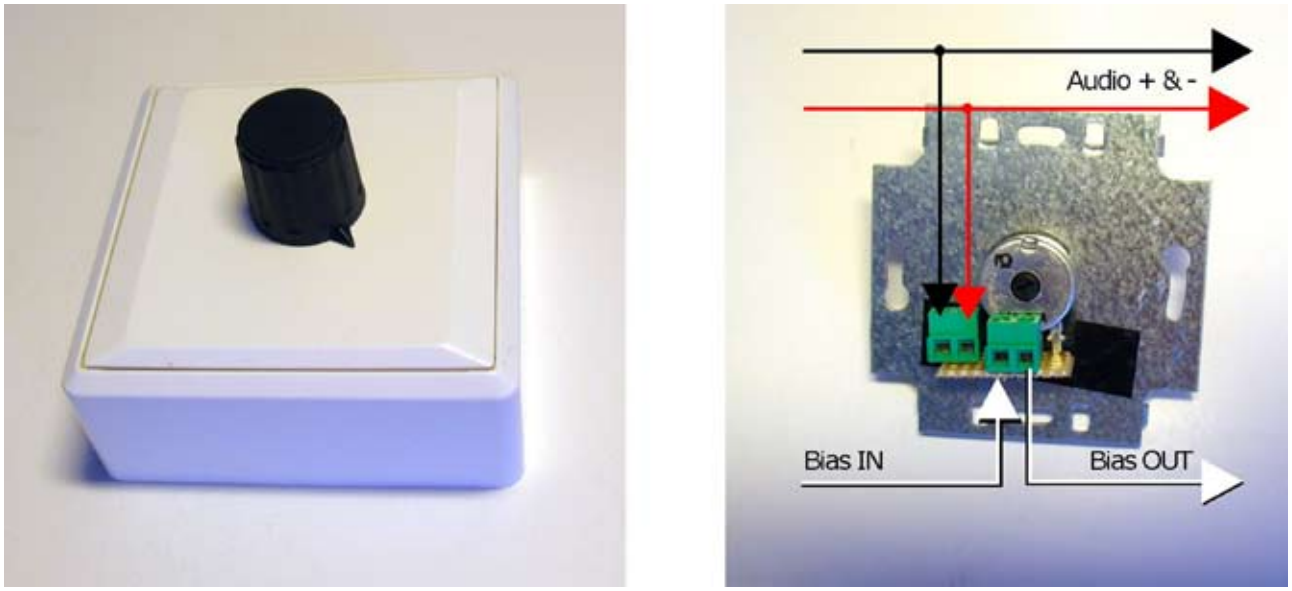

Figure 14. LAtt-9dB box and installation

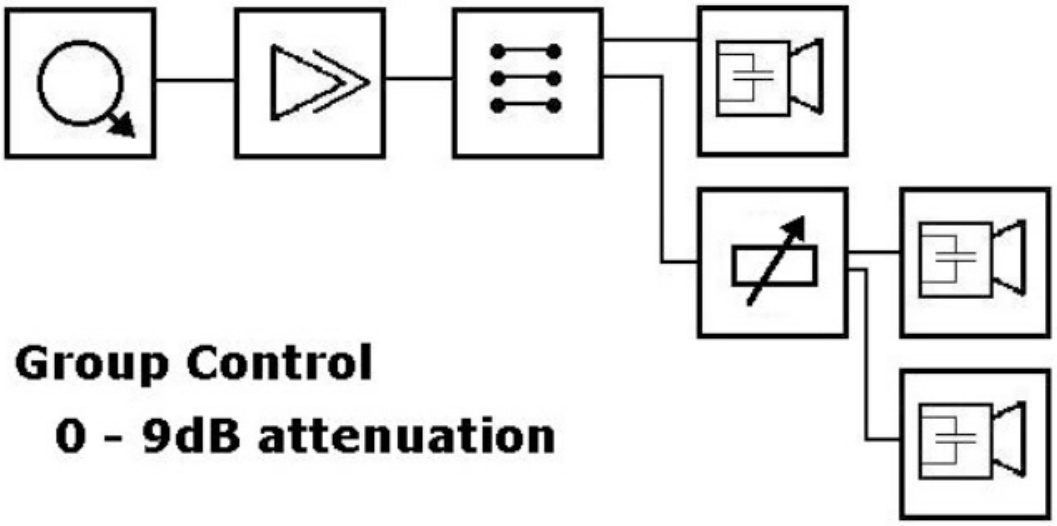

Figure 15. Example of LAtt-9dB regulator in Privacy Solution system

In Figure 15 the same media is played with one amplifier to three different speakers. Two of these are connected to a separate Panphonics Latt-9dB volume control. The system operates in such a way that the amplifier's "master" volume is repeated from the first speaker and the two speakers behind the volume control can be attenuated by 9 dB compared to the first loudspeaker.

The volume control can also be used to reduce the audio level in one spot without having to adjust the amplifier and at the same time without affecting the other speakers. The volume control should be installed to the most appropriate place for the user.

Only one regulator should be installed to one speaker line between the amplifier and the speaker/ speakers. Adding more regulators in to the same line can reduce the sound quality on the system.

Using the AA100E amplifier

Figure 16. AA100E amplifier back plate and 0.80 m cable with d-connector

Amplifier connectors / adjustments from left to right

- Microphone for ambient control
- Power on (green) and overdrive (red) LEDS
- Volume control -
- Volume control +
- 5V/100 mA USB out
- Audio IN (3,5 mm stereo plug connector)
- Gain potentiometer
- Power in; where the Panphonics PSU unit is connected

The amplifier has 4 DIP-switches. Number 1 chooses the input signal level (low/high). Number 2 turns the ambient control on/off. Number 3 turns the virtual bass on/off. Number 4 is not in use.

Adjusting the volume level

A suitable volume level settings is an essential part of the system functionality. The volume level is adjusted from the amplifier's VOL - and VOL + buttons.

The volume level should be sufficiently high to avoid the customer having to "make efforts" to understand the media content, but the sound should not disturb and interfere with staff and customer discussions.

Note: Usually in the adjustment situations, the volume is set too loud because the person adjusting the volume level and the person listening do not necessarily sit on the actual audio foot print.

When setting up the volume it should be taken into account that sound reflects from all hard surface materials. In order to avoid unwanted reflections, which spread the sound to unwanted areas it is recommended that volume level should not be set any higher than necessary.

The sound volume is correct when below the speaker on the waiting area sound and media content is clearly audible, but the sound does not carry to personnel's working areas. When adjusting the correct volume level it is advised to ask an opinion from more than one person of the staff in order to find correct and acceptable volume level for the system.

Using the AA160 amplifier

The amplifier has a place for the power supply and signal-in. The amplifier is connected to the signal cable and power supply. The green indicator light indicates power on. The desired volume level is selected by turning the volume control knob. A red LED illuminates if the amplifier over drive (in such a case the volume level should be reduced). A separate signal level sensitivity adjustment is not needed. The volume level is saved in memory until the next adjustment is made.

4.4. Using 3rd party amplifiers in Privacy Solution systems

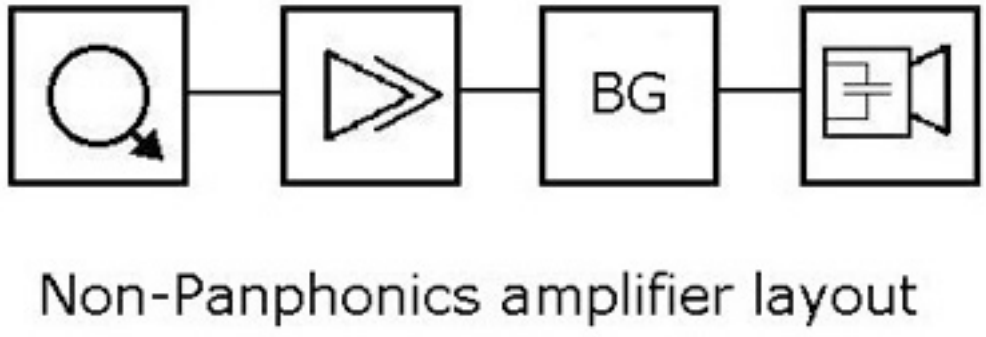

Figure 17. Privacy Solution without using the AA100e amplifier and applying the BG2.0 bias generator in passive mode

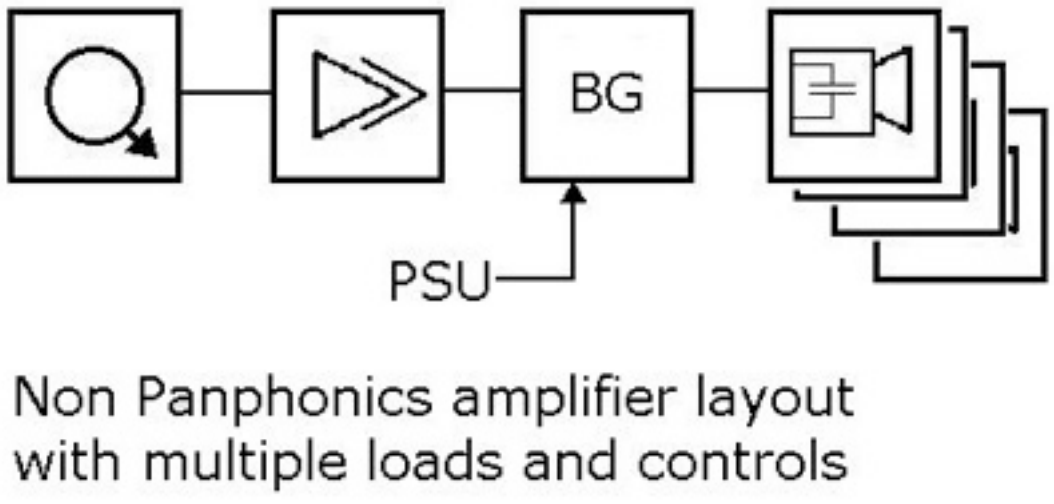

Figure 18. Privacy Solution system with active BG 2.0 bias generator

Any 3rd party amplifier used must be designed to drive low impedance load. When selecting

amplifiers the desired output voltage and possible achievable sound pressure level should be taken into consideration. By doubling the output voltage you can double the sound pressure level.

By choosing an amplifier with a 70/100V output, typically only bias voltage needs to be added. Most good quality AB- and D-class amplifiers should be able to drive Panphonics Sound Shower speakers. Choosing the amplifier should be based on the amplifier's capability to handle a low ohm reactive load.

NOTE: System design and amplifier selection is always the responsibility of the designer and/or installer. Panphonics cannot guarantee the applicability of any third party amplifiers.

4.5. Cables and connections

The AA100e amplifier is equipped with an 80 cm cable and D-connector. Extension cords (EC300) are 3 m long and equipped with D-connectors. The speakers are equipped with a 2 meter cable and D-connector.

For longer signal wirings type UL2464 AWG24 or smaller cables are recommended.

When extending the cables the following should be remembered:

- Speakers audio + wire (red) is connected with the amplifiers audio + wire. Speaker's audio wire (black) is connected with amplifier's audio wire. Speaker's BIAS wire (white) connected to amplifier's BIAS wire.
- All speakers are connected parallel to a line. In other words, the black wires combine with black, red to red, and white to white. All connections are recommended to be done into connector boxes with connector terminals inside. There should also be space for cable ties to provide cable stress release.

5. Standards, disclaimer, and warranty

The electrical components of the products are in accordance with the following harmonized standards:

Low Voltage Directive (LVD) 72/23/EEC
IEC 60065, 6th edition: 1998
Testing laboratory NEMKO Norway, order no 2003061358 (2003-Feb)

Directive of Electromagnetic Compatibility (EMC) 89/336/EEC and 93/68/EEC
Emission: EN 55103-2 (1997)
Immunity: EN 55103-2 (1997)
NEMKO Porduct Services Oy, Finland. certificate no. 103 1589 (06.02.2003)

All measurements and tests referred to in this document are made in typical indoor conditions where temperature maximum has been below 25 degree Celsius and relative humidity less than 50 percent.

The products may contain high voltage, which should be taken into consideration while installing and servicing Panphonics products. The connectors, components, and cables are not to be touched while the system is connected to electric power. All installations and maintenance should be done while the whole system is unplugged from power network. Connections can only be done by trained and approved electrician.

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