Celab
COMMUNICATIONS

Guide to audio accessories for Push-To-Talk communications

One of the most important questions when choosing two-way radio accessories is the audio environment. A communication solution has limited value if the user cannot hear incoming communication or make themselves understood when transmitting.

Guide to audio accessories for PTT communications

One of the most important questions when choosing two-way radio accessories is the audio environment. A communication solution has limited value if the user cannot hear incoming communication or make themselves understood when transmitting.

Equipment for Push-To-Talk communication, PTT, is usually equipped with powerful speakers and high-performance microphones in order to work in many environments. In some environments, however, an audio accessory may be necessary to meet the requirement.

- **Environments with high levels of noise**
- **Situations where communication needs to be more discreet**
- **Work methods where the radio needs to be protected or concealed**
- **Environments where external factors, such as wind, affect the audio**
- **Work tasks where users wear protective equipment**

Audio accessories should therefore not be selected solely on the basis of which connector fits the device. The choice should be based on how the user needs to hear, be heard, activate PTT and carry the equipment in their actual working environment.

Note

This guide primarily covers audio accessories for portable user devices.

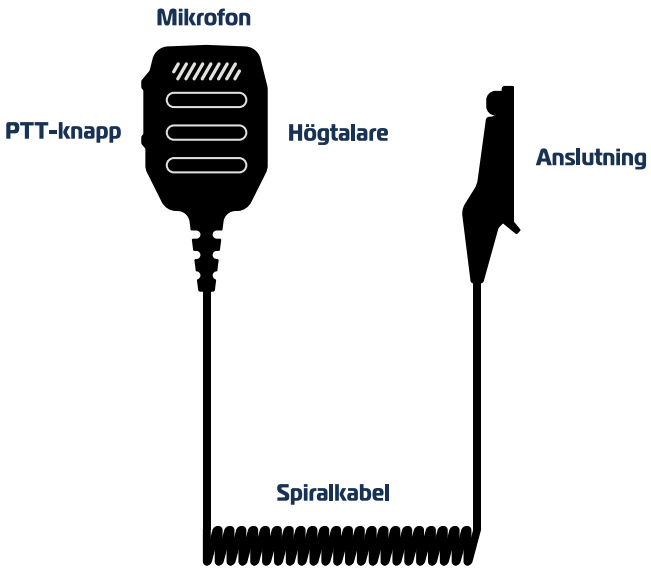
Remote Speaker Microphones

A Remote Speaker Microphone, RSM, is one of the most typical and central accessories for PTT communication.

A speaker microphone combines a speaker, microphone and PTT button in a compact unit that can be attached, for example, to the shoulder or chest. This allows the user to communicate without taking the radio out of a belt, pocket, carrying harness or bag.

Use cases

Speaker microphones are often suitable when the user continuously needs to hear what is being said and/or needs quick access to speech and PTT, while still needing or wanting to carry the radio protected, concealed or more ergonomically, for example on a belt.



They are particularly suitable when the radio needs to be accessible, but does not necessarily need to be held in the hand. Examples include operations personnel, security guards, emergency services personnel, industrial personnel and other users who need to be able to respond quickly without interrupting the work task.

However, a speaker microphone is not always sufficient in very noisy environments. In those cases, the user may need a headset or hearing protection with communication. If the communication needs to be discreet, the speaker microphone may instead need to be combined with an earphone or earpiece.

Variants

All speaker microphones have a speaker, microphone and PTT button, but beyond the basic functions they can differ significantly in several respects.

Controls

- Talkgroup / channel selector
- Shortcuts (hotkeys)
- Volume control
- Earphone jack
- Form factor and size

Functions

- Noise reduction
- Wind reduction
- Noise-cancelling microphone
- Emergency function
- Device compatibility

Performance

- Certifications
- Robustness
- Audio level
- Audio quality
- IP rating

In other words, the choice of speaker microphone should be based on more parameters than whether it "fits the radio". Pay particular attention to audio levels and IP rating, as well as connectors and controls in relation to the user's environment.

The right speaker microphone can make communication more accessible, reduce the need to handle the radio directly and support a more ergonomic way of working.

Push-to-talk buttons

The PTT button is central to all Push-To-Talk communication. When audio accessories are used, the PTT function often needs to be moved away from the device because the two-way radio, PTT device or terminal may need to be placed in a holster, concealed under clothing or carried in a bag.

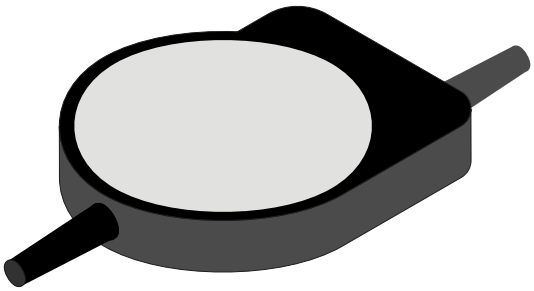
The PTT function may also need to be moved for ergonomic and practical reasons, for example because the button needs to be more accessible, easier to operate with gloves, or because several devices need to be controlled with the same PTT module.

This is where the PTT button comes in. A PTT button is a separate control that makes it possible to activate transmission without using the PTT button on the radio, terminal, PTT device or audio accessory itself.

Variants

The purpose of all PTT buttons and PTT control units is to control the PTT function. Beyond that common denominator, they can differ in design, function and requirements.

PTT buttons and PTT control units are available in several versions, from simple cable-mounted PTT buttons to more advanced control units with connections for earphones, headsets, communication kits or multiple devices.



Accessibility

- Talkgroup or channel selector
- Volume control
- Size and shape
- Intended placement
- Option for discreet placement

Features

- Noise reduction
- Wind reduction
- Noise-cancelling microphone
- Emergency function
- Device compatibility

Performance

- Certifications
- Robustness
- Audio level
- Audio quality
- IP rating / enclosure protection

For simpler solutions, the PTT button is often just a separate PTT button. In more advanced solutions, it can function as a control unit that also manages connections, settings and specific functions. The PTT button should therefore be assessed together with both the audio accessory and the device to be used. It is not enough for the button to be connectable - it must also be positioned correctly, be usable during the work task and work with the microphone, earpiece and device that the user will actually use.

Earphones

In this context, earphones are one-way audio accessories that allow the user to listen to communication without the surroundings hearing it. The user still transmits through the microphone and PTT button of the radio, terminal, speaker microphone or another accessory.

Earphones are available for one or both ears and are offered in three main categories:

- **directly connected to a radio or terminal with a short cable for a shoulder-worn radio**
- **directly connected to a radio or terminal with a long cable for a belt-worn radio**
- **connected to a speaker microphone, often through a 3.5 mm or 2.5 mm audio output**

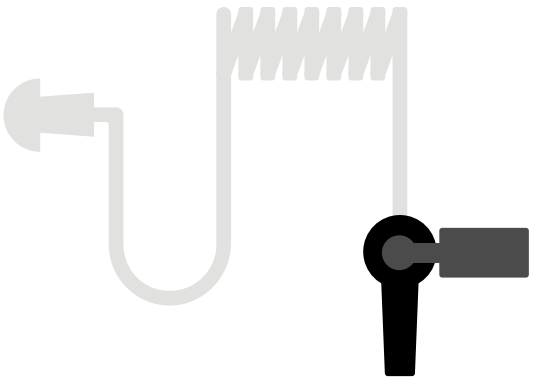
Most two-way radio earphones are suitable when incoming communication should not be heard by others - out of respect for the surroundings or because of the content of the communication. However, they require the user to still be able to use the microphone and PTT button on the radio or speaker microphone when they need to transmit, or that the user only needs to listen.

Depending on connection type and earpiece, earphones can also be suitable when the solution needs to be discreet or blend into the surroundings, with the same limitations.

Earpieces

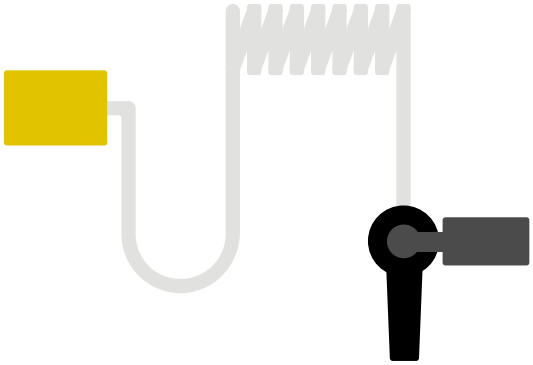
Acoustic tube

An acoustic tube, air tube or sound tube is usually a transparent plastic tube that carries sound from the speaker element to the ear canal. Acoustic tubes are available in both straight and coiled versions.



The solution is relatively discreet, light and comfortable and is often used in security, guarding and other public environments where communication needs to be received without the surroundings hearing it.

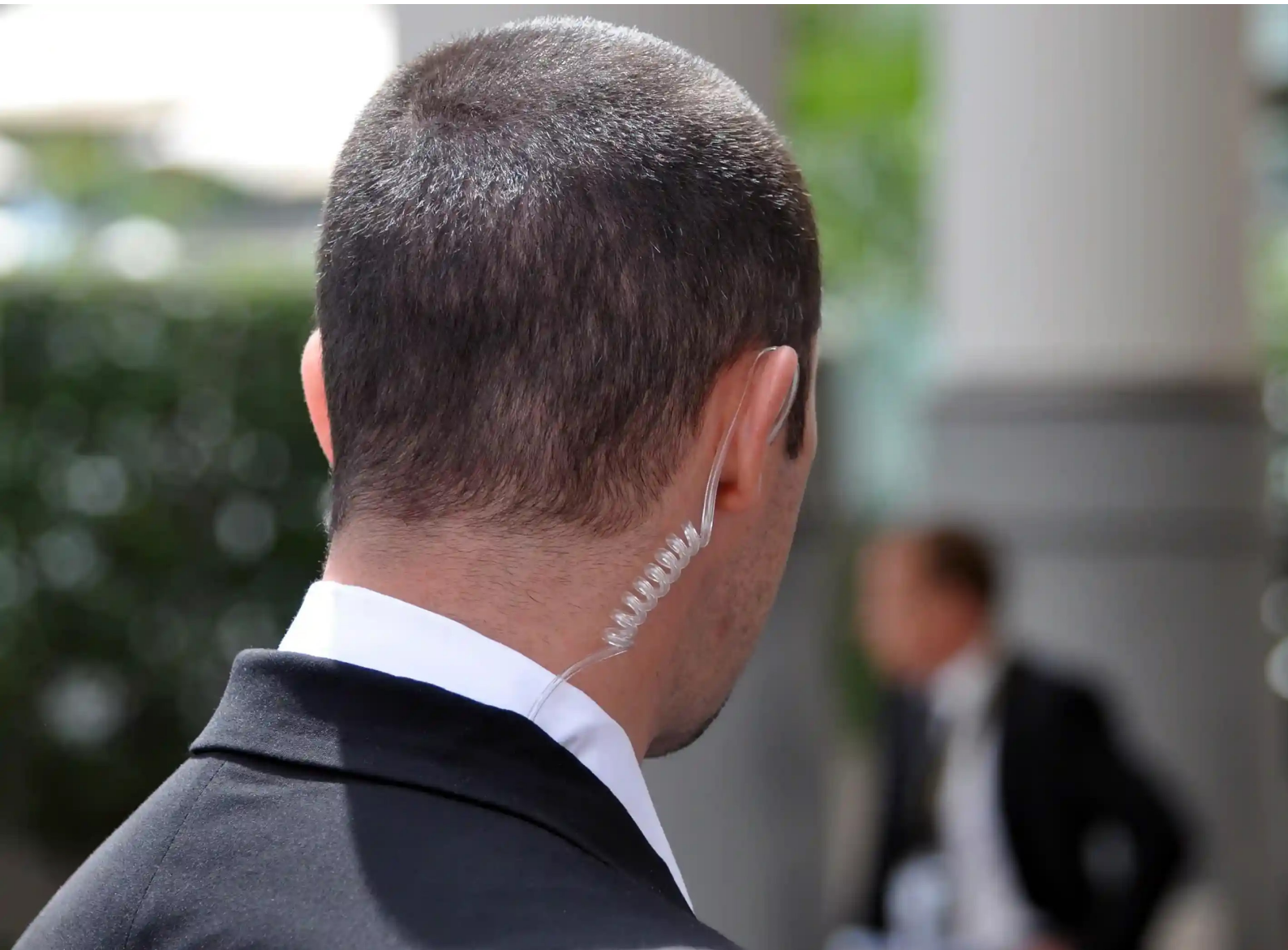
The disadvantage of an acoustic tube is that it can be sensitive to external impact and wear.



Acoustic tube with earplug

The same design as a standard sound tube, but with a mouldable plug at the end.

Suitable for the same purposes as above, but where there is also a basic need for hearing protection. There are rarely any certifications or official attenuation values for this type of solution, and it does not offer functions such as ambient listening or electronic noise cancelling - hence the word basic.



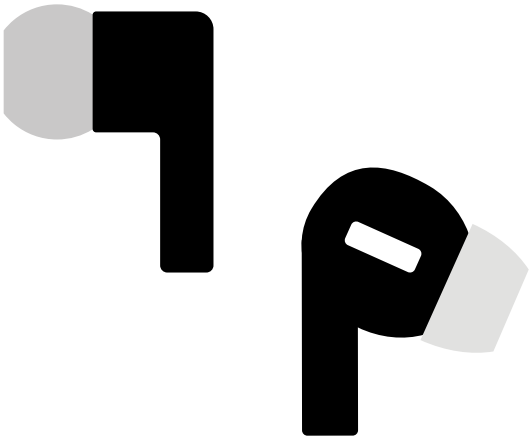
Hygiene and personal equipment

Earpieces are accessories that often come into direct contact with the ear and should therefore also be assessed from a hygiene perspective. In organizations where equipment is shared between several users, it may be appropriate to use personal earpieces, replaceable plugs or parts that can easily be cleaned and replaced.

This applies particularly to earbuds, acoustic tubes, earplugs and other in-ear solutions. Earcups, headsets and other over-ear solutions may also need replaceable ear cushions or hygiene kits, especially if they are used during long shifts or by several people.

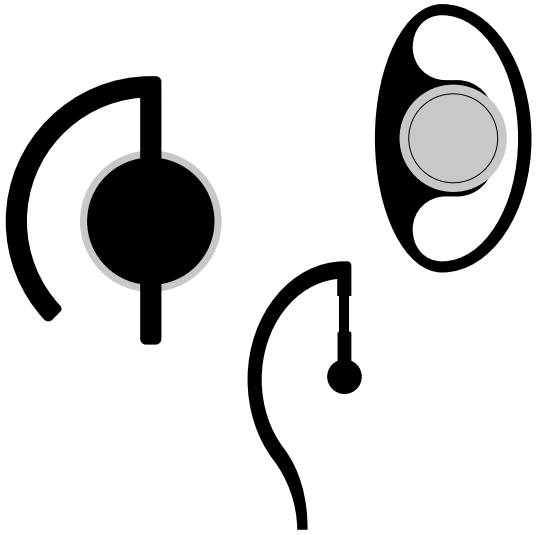
Earbud

An earbud, or in-ear earpiece, is an in-ear solution that is placed directly in the ear. They resemble consumer earphones (earbuds) and are available with different types of earplugs, foam parts or rubber details.



Earbuds are uncomplicated and light, and they blend easily into the surroundings because they resemble ordinary stereo earphones. They are therefore suitable for many users who need a simple solution for listening to traffic. With a concealed radio and directly connected earphone, the solution can also be discreet in many public environments.

The risk with earbuds is that the shape does not fit all ears. This can affect audibility as well as ergonomics, especially during longer work shifts or if the user moves around a lot.



Ear hook

An ear hook is worn around or on the ear. It can be D-shaped, J-shaped or designed in another way to sit securely without being placed deep in the ear canal.

Ear hooks can be an alternative when the user wants to receive audio without completely blocking out the surroundings. However, they can be affected by helmets, hats, safety glasses or other equipment around the head. They are also not particularly discreet.

Earcups

Earcups are over-ear headphones that are placed over the ears and can be used when the user needs to receive radio communication while ambient sound is attenuated.

If they are to be used as hearing protection, attenuation values, certifications, fit and compatibility with helmets, safety glasses or other equipment must be checked.

Note

These earpieces are also available for many of the different types of audio accessories presented later in the article.

Handsfree

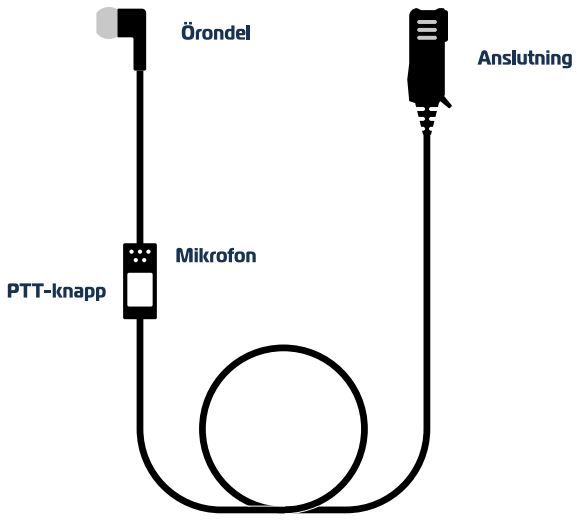
This type of audio accessory is often referred to as a "surveillance kit". Strictly speaking, true handsfree communication is normally not possible for Push-To-Talk communication since the PTT button must be pressed to transmit.

In this context, "handsfree" instead refers to earphone solutions where the PTT button and microphone are also placed on the accessory in order to simplify handling and allow the radio to be positioned discreetly or more comfortably.

Some radios and PTT devices have a so-called VOX function, Voice-Operated Transmit, which can initiate transmission when the device detects human speech and thereby free the user's hands.

Variants

Surveillance kits (handsfree) are available in several different versions:



1-wire

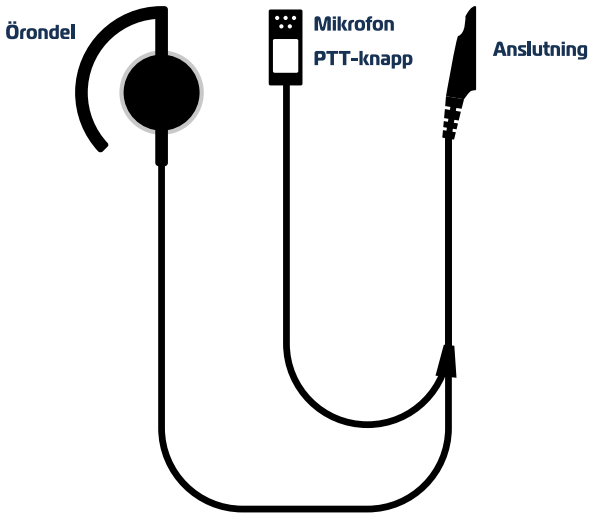
A solution consisting of a cable between the radio and speaker, where both microphone and PTT button are placed along the cable.

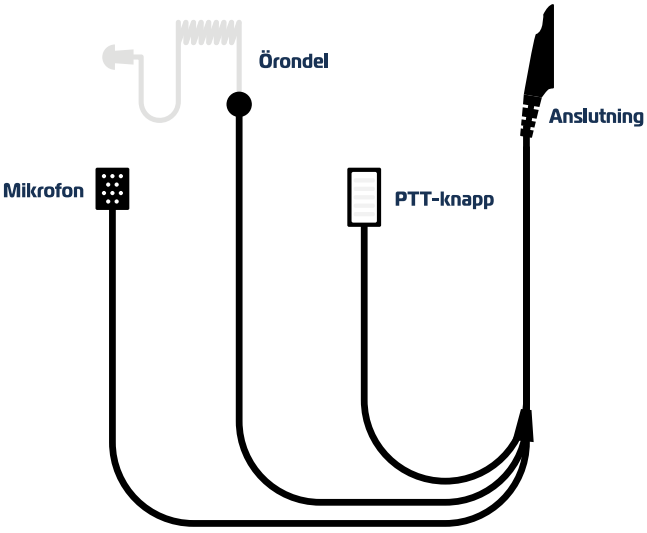
This creates a solution that closely resembles early generations of mobile headsets, which suits users who do not want to draw attention to the fact that they are using a two-way radio.

2-wire

Consists of two separate cables, where one end terminates in a speaker element while the other terminates in a combined microphone and PTT button.

This allows, for example a covert user to route the microphone and PTT to the hand through the sleeve of a shirt, while the speaker element is placed in the ear.



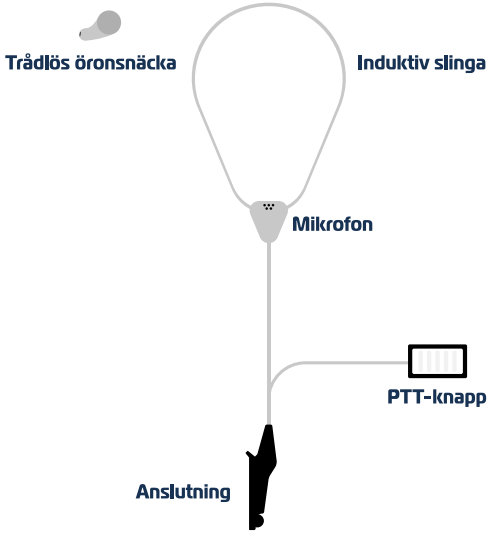


3-wire

A variant where the speaker element, microphone and PTT button are each placed on separate cables. This means that the microphone can be placed, for example, on the button placket of a shirt, while the speaker element is in the ear and the PTT button remains in the shirt sleeve.

Inductive

A common inductive solution uses a loop around the user's neck that transmits audio to a small earbud. These are primarily used when the communication needs to be "invisible" and a visible cable to the ear is not an option. The solution can also have a separate microphone and PTT button and can be supplemented with wireless PTT.



Specialized microphone and audio solutions

In some working environments or work situations, an earphone, handsfree solution, headset or other traditional solution is not sufficient or not suitable.

In those cases, specialized microphone and audio solutions may be relevant. In this guide, we use specialized microphone and audio solutions as a collective term for these types of accessories. Communication kits are often developed for specific use cases, and even greater importance must therefore be placed on the working environment, the user's equipment and how communication will take place in practice before selecting a solution.

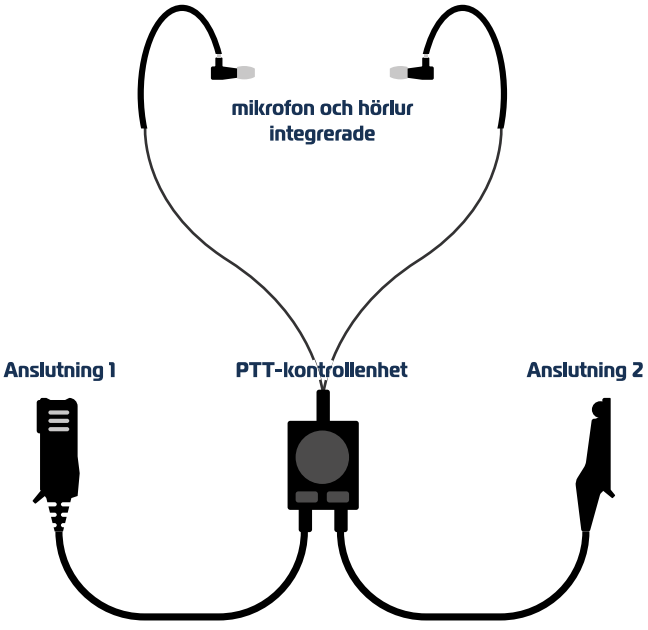
This can involve situations:

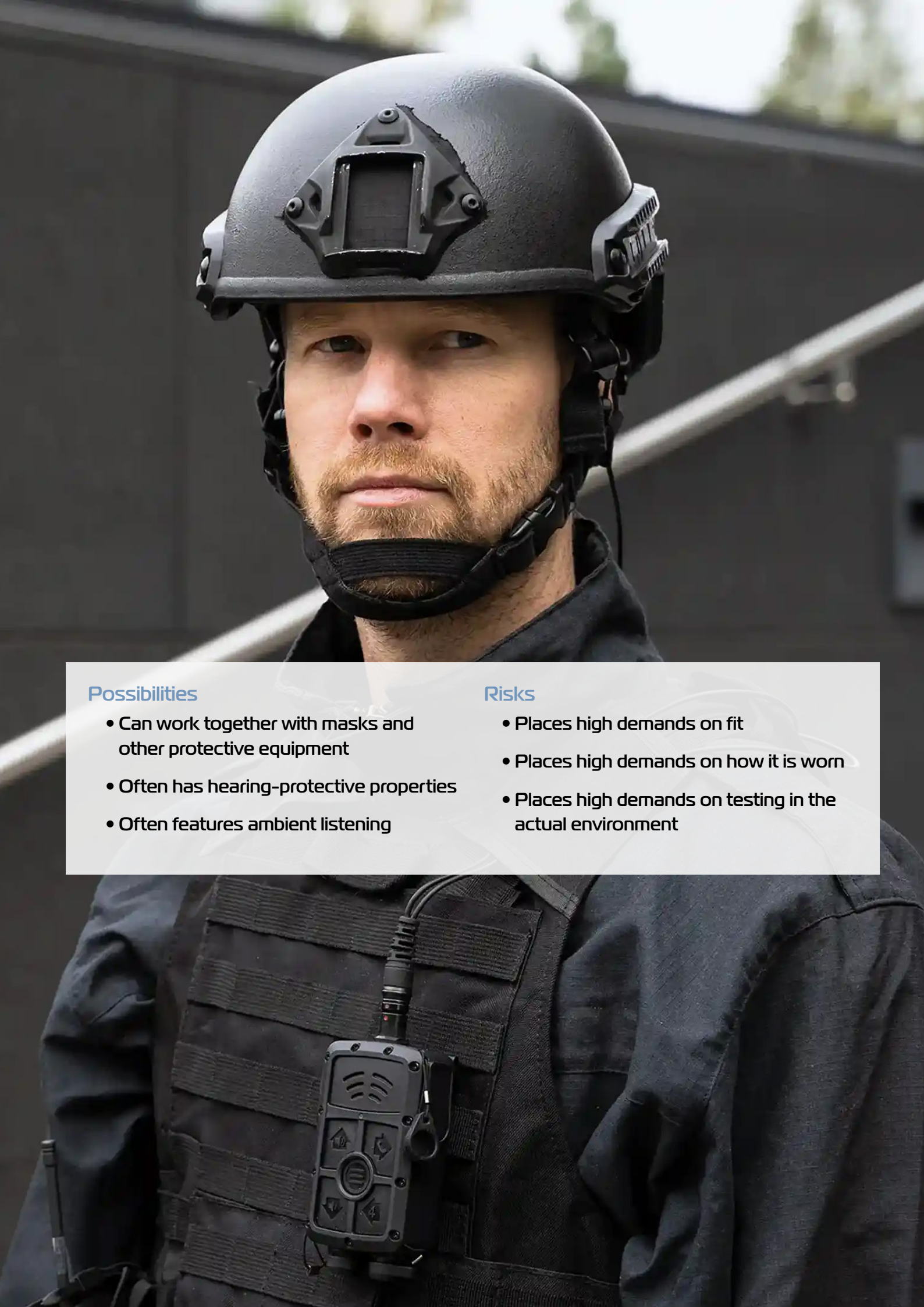
- **with very high noise levels**
- **with strong wind**
- **where the user cannot wear a microphone in front of the mouth because of, for example, protective equipment, helmet or mask**

Ear microphones

An ear microphone is an audio accessory solution where the microphone is placed on the earpiece together with the speaker element in order to pick up the user's speech through the ear canal.

All ear microphones are designed as earbuds with sound-attenuating properties because the microphone needs to be protected from ambient sound. This means that the communication is not affected by ambient sound to the same extent as with a conventional "external" microphone. Since no microphone is required in front of the mouth, the solution can also be used together with masks, helmets and other protective equipment.





Possibilities

- Can work together with masks and other protective equipment
- Often has hearing-protective properties
- Often features ambient listening

Risks

- Places high demands on fit
- Places high demands on how it is worn
- Places high demands on testing in the actual environment

Throat microphones

A throat microphone, sometimes called a laryngophone, picks up vibrations from the larynx instead of primarily capturing sound in front of the mouth. Since the throat microphone does not depend on capturing sound through the air, it can be useful in environments with very high background noise.

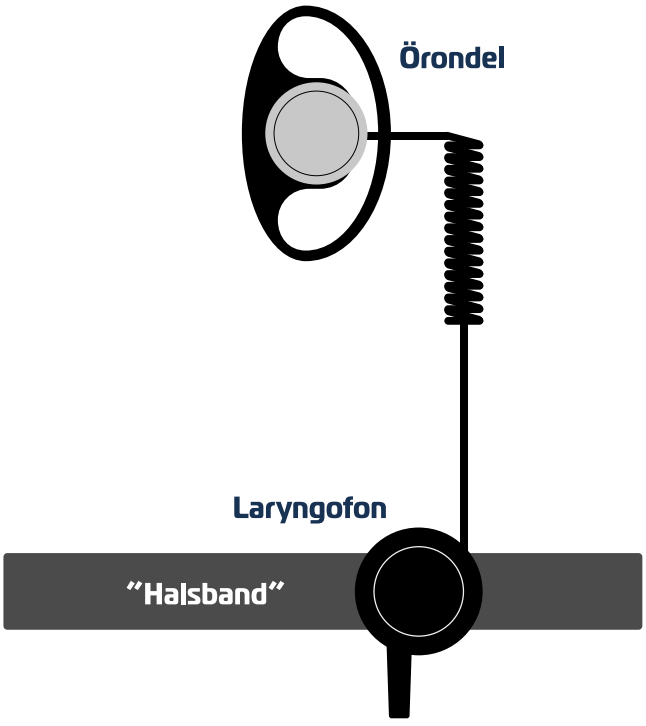
The microphone is placed against the throat and can therefore work even when the user is wearing a mask, helmet or other equipment that makes conventional microphone placement difficult. However, the throat microphone needs to be complemented with a suitable earpiece or headset, because the speaker element is not integrated as it is in an ear microphone.

Possibilities

- Can work together with masks and other protective equipment
- Can pick up the user's voice even in very high noise levels or wind noise

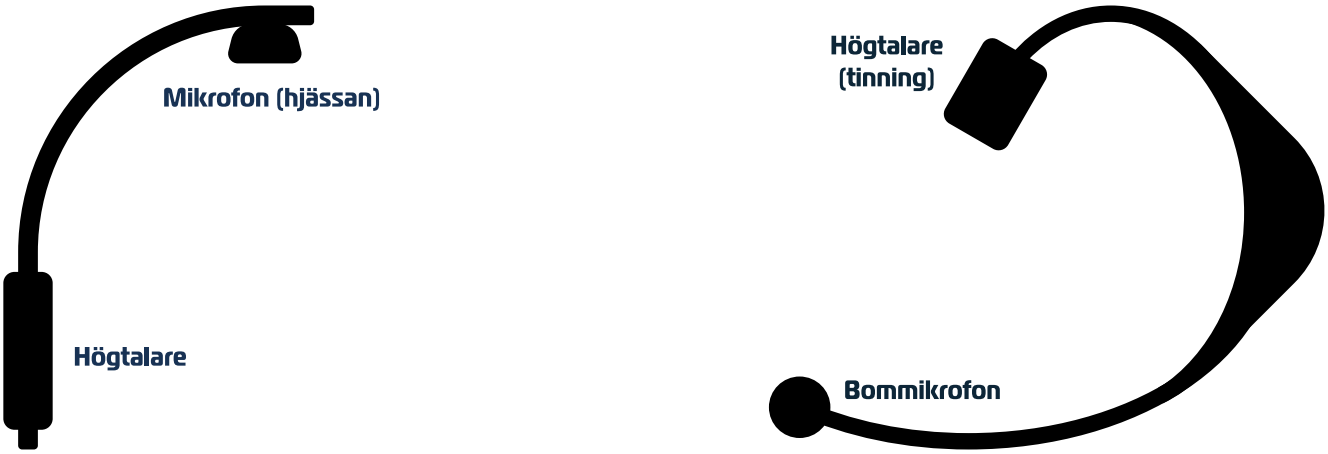
Risks

- Can distort voices
- Requires a complementary earphone or headset
- Can create uncomfortable pressure against the throat



Bone-conduction solutions

Bone-conduction, or transducer-based, solutions transmit or capture audio through vibrations in the body, often through contact with the skull, cheekbone or another surface near the head. Instead of relying only on airborne sound, they can use vibrations to transmit speech or received audio.



Such solutions can be relevant when the user needs to keep the ears free, when ambient sound still needs to be perceived, or when traditional earphones and microphones do not work together with certain helmets, masks or protective equipment.

Choose a specialized solution only when the need requires it

Specialized microphone and audio solutions can solve problems that ordinary audio accessories cannot handle. At the same time, they are often more dependent on the right fit, the right user, the right connection and the right working environment.

They should therefore not be selected only because they seem technically advanced. Start by identifying the problem to be solved: noise, discretion, protective equipment, wind, helmet, mask, ergonomics or the need to keep the ears free. Then choose the solution that solves that specific problem with as little complexity as possible.

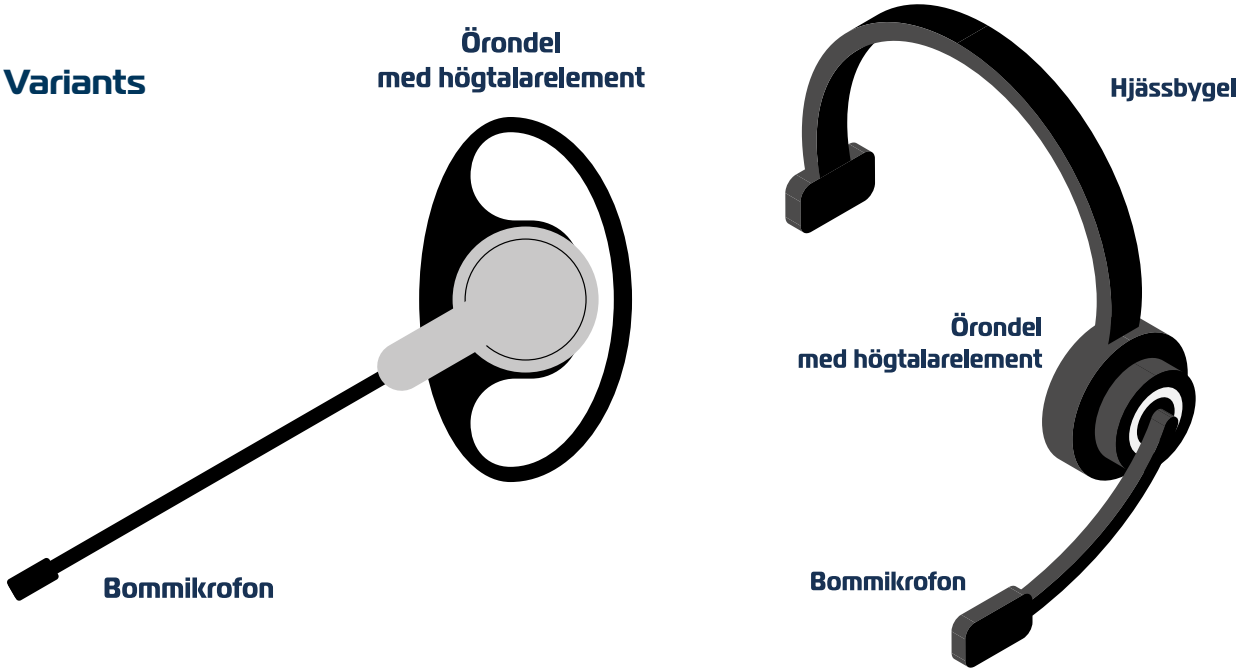
Headsets

By headset, we mean an audio accessory that is placed on or over the ears together with an adjustable microphone, known as a boom microphone. Headsets are usually equipped with a headband that is worn over the head, behind the neck or mounted on a helmet.

Lightweight headsets

A lightweight headset is a type of communication headset that does not protect hearing.

Variants



Ultralight

An extra-light variant without a headband, where the speaker element is hung on the ear together with a foldable boom microphone that can be positioned at the mouth.

Lightweight

A variant with a headband that provides audio in one or both ears. These are available with boom microphone, microphone on cable and special microphones. Over-head bands and neckbands are common, while helmet mounting is rare.

Use cases

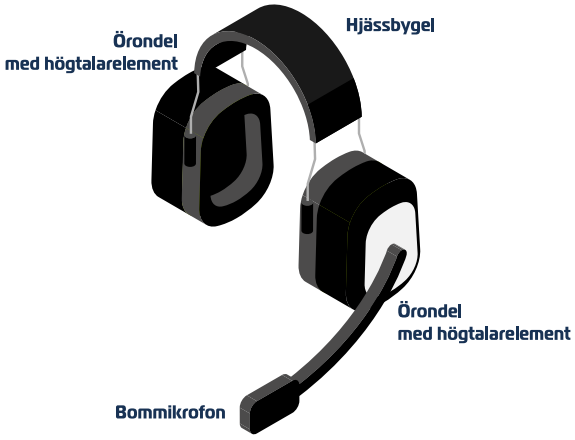
Lightweight headsets are suitable in environments where the ambient noise level is not too high, for example in offices and warehouses. They can be used outdoors, but they are best suited indoors because they are rarely protected against weather and wind in the same way as other headsets and audio accessories.

Hearing protection with communication

In noisy environments, hearing protection with integrated communication may be necessary. These are sometimes referred to as heavy-duty headsets. They can also be described as noise-attenuating headsets, but the most important difference is that they must both protect hearing and enable clear voice communication.

The same factors that make hearing protection necessary often also make communication more difficult. This places higher demands on microphone placement, noise reduction, fit and comfort.

Here, it becomes particularly important to consider the working environment, noise level, certifications, comfort and how long the equipment will be worn.



Variants

All noise-attenuating headsets provide two-way communication, but there can be major differences between models and manufacturers. The following are some of the aspects that can differ.

Design

- Connections
- PTT button
- Volume control
- Form factor, size and weight
- Helmet attachment, headband or neckband
- Hygiene, cleaning and replaceable parts

Features

- Active noise reduction
- Active hear-through / ambient listening
- Noise-cancelling microphone
- Device compatibility
- Wired or wireless use
- Support for one or multiple devices

Performance

- Certifications
- Attenuation values
- Comfort
- Robustness and IP rating / enclosure protection
- Audio level and audio quality
- Battery life and range during wireless use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Connections

The connection affects more than whether an audio accessory can be plugged in. It can also affect compatibility, functionality, audio performance, PTT function, power supply and, in some cases, certifications and approvals.

Many radios, terminals and PTT devices are developed for specific use cases, user groups or working environments. This often means that the accessories available for the device are also adapted to the same requirements. In other words, all types of audio accessories are rarely available for all types of devices.

The connection should therefore not be viewed as a detail at the end of the accessory selection process. It is a basic prerequisite for the accessory to work in the right environment, with the right user and together with the right communication equipment.

In cases where the audio accessory is critical to the user's way of working, it may be better to start with the accessory requirement and then identify which radio, terminal or PTT device works best with it.

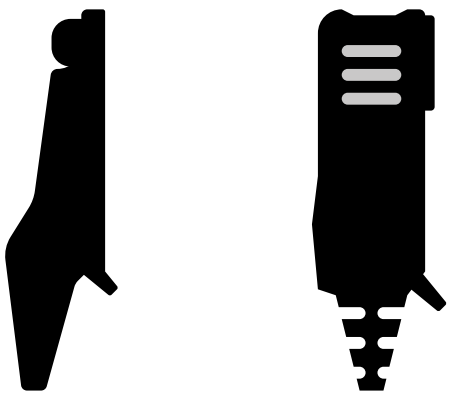
Physical connection

Wired connection is still the most common form of connection for professional audio accessories for two-way radios, terminals and PTT devices.

Cable-connected solutions often provide more predictable and stable functionality. This normally gives a more reliable user experience in demanding or varying environments.

A solution with audio accessories can consist of several links:

- a connection to the main device (radio, terminal, PTT device, smartphone, etc.)
- an adapter or adapter cable
- a speaker microphone, PTT button or PTT control unit
- an earpiece, communication kit or headset



Connection to the main device

Regardless of the solution used, the connection in the first link needs to fit the radio, terminal or PTT device that will be used - both mechanically and functionally.

Many main devices have their own accessory connectors, adapted for a specific model or product family. This means that accessories, cables and adapters often need to be terminal-specific, even if the accessory at the other end uses a more general connector standard.

Direct connection

A directly connected accessory is connected directly to the radio, terminal or PTT device without a separate adapter. It is one of the most common wired connections, because the most common accessories usually use a device- or terminal-specific connector. The same applies to the majority of the manufacturer's original accessories.

In addition, depending on device type and manufacturer, there are communication kits, headsets and other accessories that are developed for a specific model or product family.

- **The advantage is that the solution is often simple, robust and clearly adapted to the device.**
- **The disadvantage is that the accessory can become locked to that model or product family.**

Distinguish between physical connection and actual functionality

An accessory can have a connector that fits, but still lack support for certain functions. A manufacturer may use the same connector for several product families. However, the main devices may differ technically and electronically, which means that an accessory can have limited functionality, reduced performance or no support for certain functions - even though the connector fits.

Connection via adapter

In many solutions, an adapter, adapter cable or interface is used between the main device and the audio accessory. The adapter part then adapts the accessory to the radio, terminal or PTT device that will be used.

- **The advantage is that the same audio accessory can be used with several different main devices.**
- **The disadvantage is that it increases complexity. It can also result in reduced compatibility and more potential sources of error.**

The adapter needs to do more than just fit

Not all terminal-specific connectors from third-party manufacturers are identical. Even if the connector is mechanically adapted to a certain terminal, functionality and performance can be affected if the accessory has not been developed based on a complete technical specification, official support or tested integration with the device in question.

Connection via speaker microphone, PTT button or PTT control unit

In some accessory solutions, the "final" audio accessory is connected through a speaker microphone, PTT button or PTT control unit. The speaker microphone, PTT button or PTT control unit is in turn connected to the main device directly through a terminal-specific connector or with an adapter.

- **The advantage is that this intermediate link can increase the flexibility of the solution or make it more adapted to the use case.**
- **The disadvantage is again increased complexity and more potential sources of error.**

Connecting earpieces and other audio accessories

Earphones, earpieces, communication kits and headsets can be connected to the main device in several different ways: directly, via an adapter, or via an intermediate link such as a speaker microphone, PTT button or PTT control unit.

When the audio accessory is not connected directly, there are several recurring connector types, such as NEXUS, Hirose and 3.5 mm. Which one is used mostly depends on how many functions the accessory has. For more advanced audio accessory systems, manufacturer-specific connectors and cables are therefore often used.

The advantages and disadvantages from this perspective vary depending on the main device, accessory and, not least, the use case.

Do not confuse physical fit with technical compatibility

A connector may look the same and still not work. For example, the common NEXUS connector can occur with different pinouts in order to support different functions. The connector may fit mechanically, but if the pins are wired differently, the accessory will not work as intended.

This may mean that the speaker, microphone, PTT button or other functions do not work even though the connector can be plugged in. Similar situations can occur with Hirose connectors and other recurring connector types.

Wireless connection

Wireless audio accessories can provide greater freedom of movement. They can be advantageous when the user moves around a lot, uses protective equipment or needs to reduce the risk of cables getting caught.

At the same time, wireless connection adds more factors to assess and, over time, administer and maintain.

- battery life
- range
- pairing
- latency
- audio quality
- support for PTT function
- susceptibility to interference

Standard protocols

Bluetooth and other standardized wireless protocols can be used to connect many audio accessories to different types of main devices.

This can be a flexible alternative, especially for users working with more "consumer-like" devices. For simpler receiving or calls, standardized solutions can work well.

For PTT communication, however, more than the audio connection itself needs to be checked. The accessory also needs to support the correct PTT function, the correct audio profile and a sufficiently stable connection for the working environment in which it will be used.

Check and test before implementation

If the wireless accessory lacks support for PTT functionality, there is a risk that it will need to remain active continuously, which negatively affects battery life and may cause the user to miss incoming communication because the accessory is busy.

Standard protocols with manufacturer-specific functions

Some solutions use a standard protocol as the basis, but supplement it with manufacturer-specific functions. This may involve, for example, better support for PTT, status, audio profiles, emergency functions, pairing, audio prioritization or integration with specific radio functions.

This type of solution can provide more functionality than a standard wireless headset, but requires the radio, terminal, application and accessory to be intended to work together.

It is therefore important to check which functions are actually supported in the specific combination, not just that the accessory uses a known wireless protocol.

Manufacturer-specific wireless solutions

In some solutions, the wireless connection does not take place directly from the main device. Instead, an adapter, gateway or PTT control unit is used, connected to the main device's terminal-specific connector, and then creates a wireless interface to the audio accessory.

This may be relevant, for example, when a radio or terminal lacks built-in support for the wireless solution, or when the accessory comes from a third-party manufacturer with its own wireless system. The PTT control unit can then function both as the connection to the main device and as the control point for audio, PTT and wireless transmission.

This type of solution needs to be assessed as an entire chain. It is not enough for the wireless accessory to work with its adapter. One also needs to check that the adapter works with the correct main device, that the PTT function is handled correctly, and that audio, battery life, range and any certification requirements are met.

Note

In environments with specific requirements for ATEX, IP rating or hearing protection, one should check that the entire combination of main device, adapter, cable and audio accessory meets the requirements.

About Celab

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Celab Communications AB is a Swedish company within the Tången Group that, since its founding in 1978, has achieved significant success in mission- and business critical communications.

By this, we mean solutions for organizations where reliable communication is essential to operational success and/or employee safety.

The company's foundational idea is to provide communication systems based on world-leading equipment, which, through our unique expertise, are developed, refined, and optimized specifically for our customers and their unique operations.

Celab COMMUNICATIONS

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