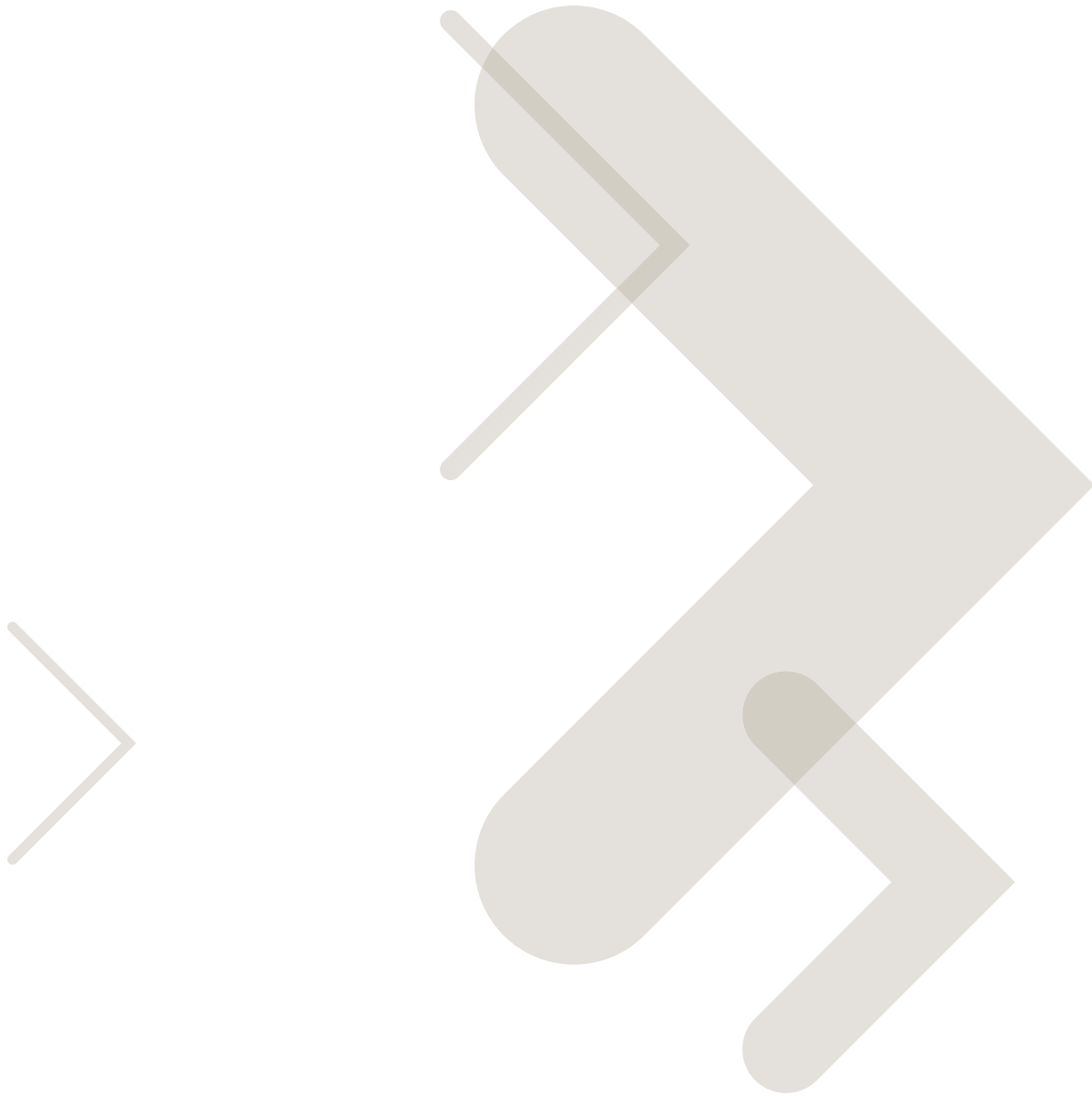




# Bringing Quality Audio to Two-Way Radios: Motorola IMPRES™ Audio Accessories



## Abstract

Busy professionals on the move require two-way radio audio that is clear, intelligible, and at a comfortable volume. In addition, managers in both the private and public sector are looking for ways to boost worker productivity while enhancing two-way radio flexibility and improving operational costs. Audio quality that varies with each system, each user, and with each usage scenario can affect company productivity and operational costs. Meeting the needs of the professional two-way radio user requires a productivity-enabling solution that significantly enhances and optimizes audio quality.

Motorola introduces the concept of intelligent, adaptable audio accessories with the IMPRES™ accessory portfolio available on Motorola's MOTOTRBO™ digital two-way radios. Exclusive technology (patent pending) only from Motorola, IMPRES provides businesses and agencies with a solution that optimizes the key aspects of two-way audio quality—loudness, clarity, and intelligibility. Designed with the needs of today and tomorrow in mind, the intelligence of IMPRES boosts workforce productivity and departmental efficiency.

### Tough Working Conditions Demand Superior Audio Quality

The success of private security, hospitality, and undercover operations depend on consistent and reliable two-way radio communications. Unfortunately, several factors such as high background noise, microphone placement, and differences in microphone audio performance significantly reduce receive audio intelligibility and clarity, degrading team productivity.

To confront current and future challenges, businesses and agencies are looking for ways to replace or supplement existing two-way radio applications with productivity-boosting solutions that are cost effective and scalable. Professionals from a wide range of industries can benefit from “intelligent” audio accessories containing information that the two-way radio can use to optimize audio output. To make this possible, the audio accessory and two-way radio must have the ability to “talk” to each other.

### Intelligent Audio Accessories Enable Mission Effectiveness

Audio quality is more than just loudness—intelligibility and clarity are also critical factors. Workers using traditional two-way radios and audio accessories may find that audio quality varies with each system, and with each user. Volume can be loud or soft, voice intelligibility fluctuates, and sound clarity muddy or inconsistent. In the field, ad hoc audio quality can sometimes make communication difficult and cumbersome, requiring users to constantly adjust receive audio volume to compensate for high background noise and differences in clarity.

In this white paper, Motorola unveils how businesses and agencies can improve workforce productivity by bridging the communication gap between two-way radios and audio accessories. The pages that follow provide an overview of the enabling technologies that allow teams to operate in the field with accessories that significantly enhance audio quality. As a result, workers experience improved operational efficiency.

### IMPRES Intelligent Accessories Optimize Two-Way Audio

Building upon more than 65 years of experience developing two-way radios and wireless technologies, Motorola knows what it takes to design reliable, productive, and cost-effective communication systems. Motorola's innovative IMPRES audio technology provides intelligent communication between MOTOTRBO radios and audio accessories, enhancing the capabilities and performance of two-way radio systems. MOTOTRBO radios coupled with IMPRES accessories allow users to experience optimal audio quality and increased customization, helping to enable consistent and reliable two-way radio communications while boosting team productivity.

Motorola MOTOTRBO Professional Digital Two-Way Radio Systems present expanded digital voice, data, and control capabilities for a wide variety of industries. Time division, multiple access (TDMA) digital technology increases calling capacity while reducing repeater costs. In addition, integrated voice and data supports text messaging, GPS location services, and other options. Specially engineered digital voice processing and accessory communication make MOTOTRBO the pioneering system for IMPRES intelligent audio accessories.

## Innovative Technology Drives IMPRES Audio

IMPRES audio accessories contain a next generation, multi-function, multi-pin connector. The connector provides a direct path for communicating to MOTOTRBO radios operating in either analog or digital mode. Exclusively from Motorola, this technology (patent pending) is similar to the design approach used within IMPRES charging systems.

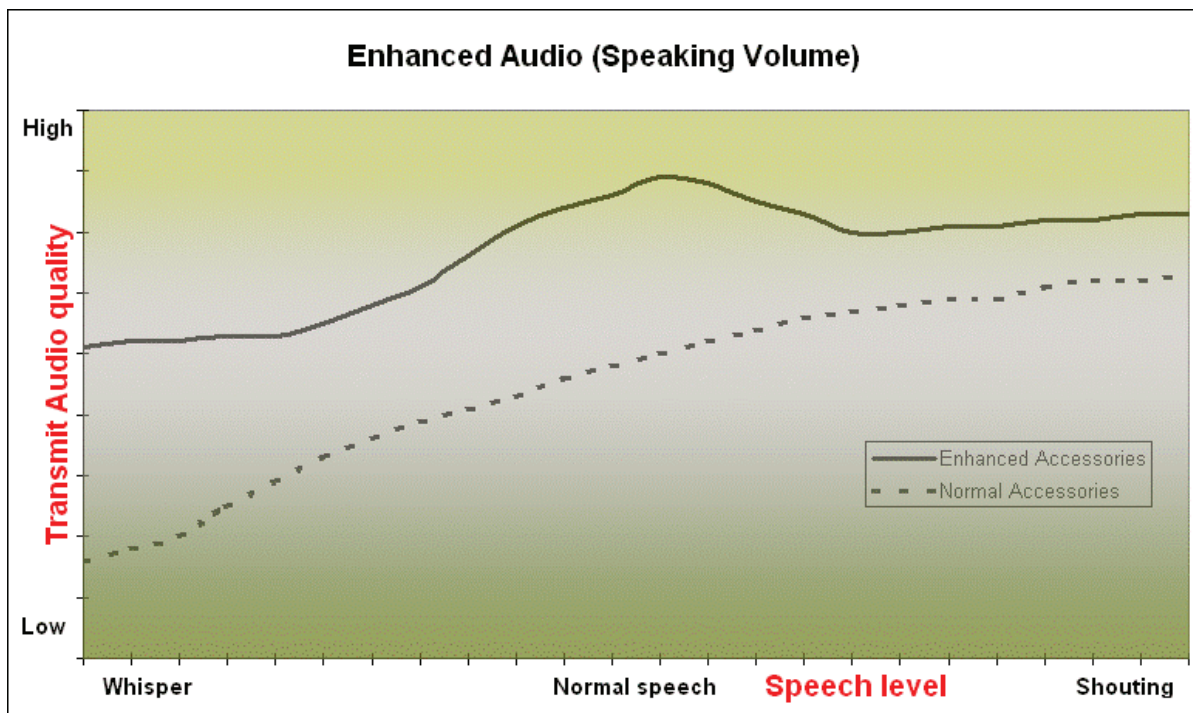
Each IMPRES audio accessory stores information that describes the audio characteristics of each audio accessory. During power up, or when a user attaches the accessory, the two-way radio reads the IMPRES accessory's characteristics, and then adjusts audio levels for optimum speaker and microphone performance. Once attached, the accessory instructs the radio how to optimize receive and transmit audio for that specific accessory. This is a critical function because the radio transmits different volume levels depending on whether the user connects a surveillance kit, remote speaker microphone (RSM), or temple transducer and each accessory may exhibit different audio characteristics.

## IMPRES Noise Compensation Boosts Audio Clarity

Workers often operate in high-noise environments that degrade two-way radio accessory audio quality. Unfortunately, background noise makes listening for long periods a difficult chore and remains a primary source of listener fatigue. In these situations, listeners may miss or misinterpret transmitted audio, reducing team effectiveness or jeopardizing critical surveillance tasks.

Using the latest in audio processing technology, MOTOTRBO two-way radios contain a digital signal processor (DSP) that fine-tunes the source audio signal using gain normalization, filtering, and other performance-boosting algorithms. When a user connects an IMPRES accessory to a MOTOTRBO radio, the accessory provides the radio's DSP with a unique set of audio parameters to shape the microphone and speaker frequency responses, which optimizes transmitted audio content.

For the listener, the noise compensation algorithm optimizes the accessory's audio performance, improving microphone audio clarity so that the listener hears the conversation in high quality—any background noise interference is reduced. The result is reduced listener fatigue and improved mission productivity. When used with wind-proof microphone enclosures, IMPRES boosts audio quality even further.



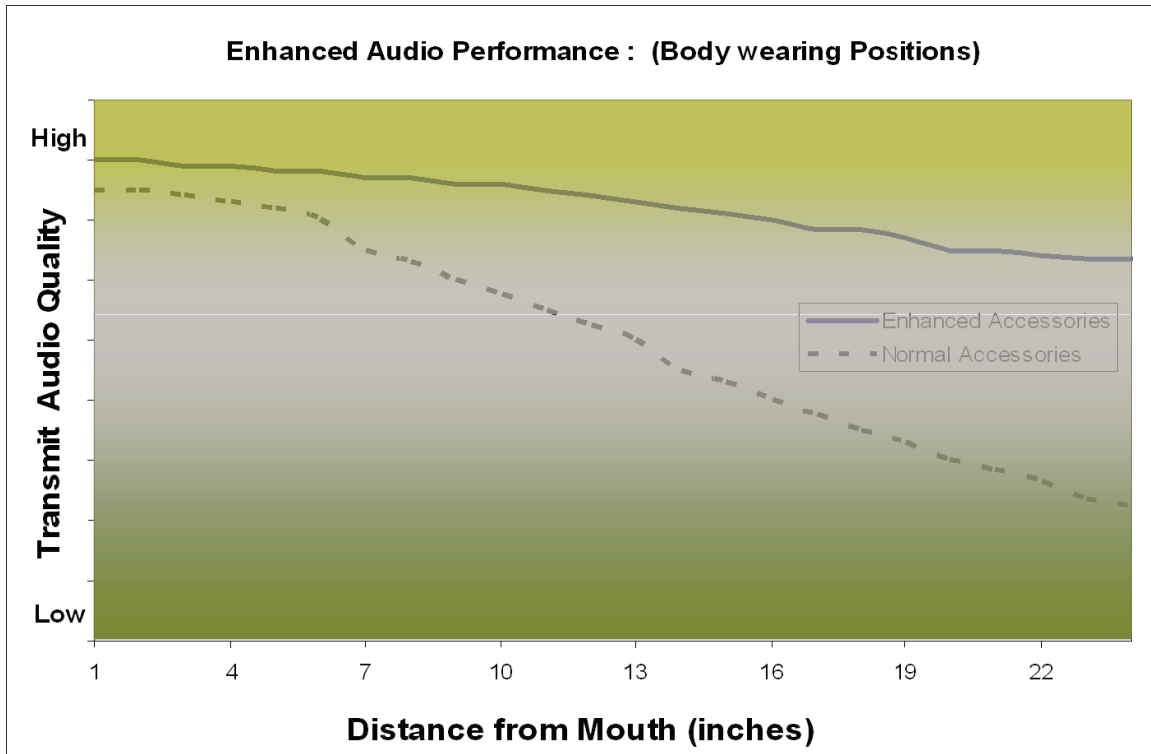
## Automatic Gain Control Delivers Reliable Audio Volume

Because clothing and distance from a person's mouth affect audio quality, users of traditional two-way radio accessories must place the microphone in an optimal location, but this is not always possible. If the user places the microphone on a collar, or under clothing, audio volume varies greatly when the user turns their head while speaking. The result is a loss of audio intelligibility and clarity, and reduced flexibility in microphone placement—a critical factor in covert surveillance operations.

MOTOTRBO radios include automatic gain control (AGC) algorithms to optimize microphone sound level consistency. AGC is an adaptive algorithm in which the radio dynamically adjusts the microphone gain such that the resulting signal remains at a consistent level. In two-way radios, AGC lowers the volume when the audio signal strengthens and raises the volume when the signal weakens.

When an IMPRES accessory connects to a MOTOTRBO radio, the radio uses the accessory's audio parameters to compensate for the microphone's distance from the speaker's mouth. The radio's AGC algorithm enables a wider dynamic range than traditional audio accessories. Motorola designed IMPRES so that if a user wears a surveillance kit under their clothes or an RSM on their shoulder and looks forward while speaking, the AGC makes up for much of the sound level difference.

Just as important, whenever a user speaks either quietly or normally, though not directly into the microphone, the MOTOTRBO radio detects the condition and automatically increases the microphone gain so that the person on the receiving end still hears a clear transmission at a consistent volume level. AGC eliminates the need to adjust volume levels repeatedly, freeing up the team to focus on the task at hand, and not the audio accessory. Listeners hear a consistent audio level even though the microphone accessory remains further away in a less optimal use position, or when worn covertly—enabling a wide range of multiple use positions.



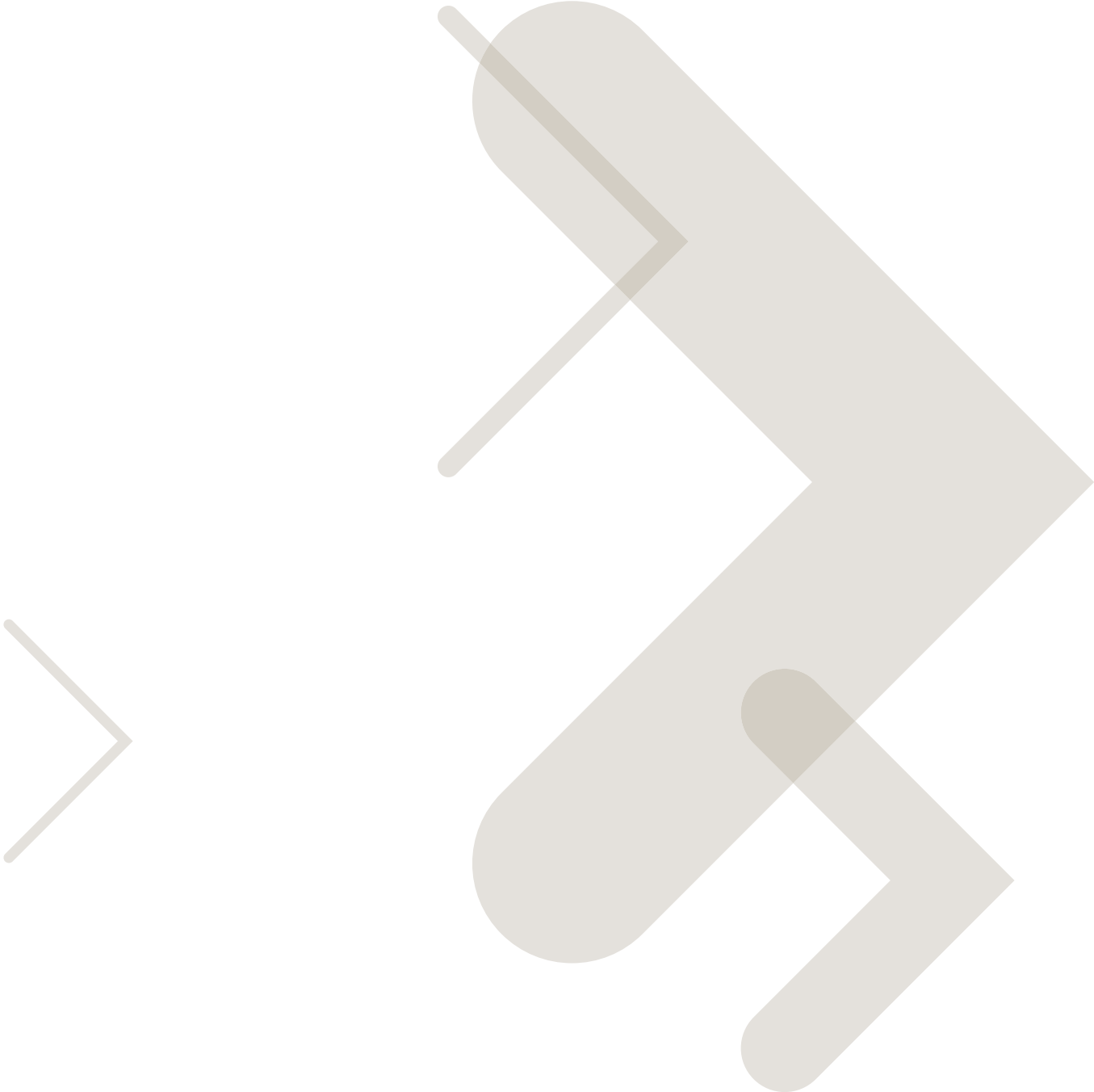
### IMPRES Technology Enables Expandability

The next generation IMPRES audio connector design provides enhanced performance and capabilities for MOTOTRBO two-way radios in both analog and digital modes, now and in the future. Other major benefits Motorola Original® accessories deliver to further enhance the MOTOTRBO accessory portfolio include:

- Programmable buttons that users can configure to any two-way radio setting, giving IMPRES audio accessories radio-independent flexibility.
- The connector includes the radio frequency (RF) antenna signal—eliminating the need for an external RF adapter for public safety microphones.
- Meets IP57 requirements for submersible RSMs that provide reliable communications—even in wet conditions.
- USB capability for easy connection to other USB-capable certified and tested accessories.

### With IMPRES, High Quality Two-Way Radio Audio Becomes Today's Reality

MOTOTRBO two-way radios coupled with IMPRES audio accessories deliver the optimal audio quality and performance that today's professional requires. Through the power of innovation and an intelligent communication interface, IMPRES audio accessories automatically compensate for background noise and microphone placement, eliminating the need for the user to constantly adjust receiver volume. With MOTOTRBO and IMPRES, teams can maintain reliable two-way communication—along with the peace of mind that audio loudness, intelligibility, and clarity remains consistent even in high-noise environments. The result is a more effective and efficient worker on the job, and a better value to your bottom line.



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