


# ADVANCING TO THE NEXT STAGE IN AUDIO PERFORMANCE WITH THE NEW MOTOROLA TETRA PORTABLES

# CLEAR VOICE COMMUNICATIONS IN STRESSFUL AND NOISY SITUATIONS REMAINS A PRIMARY REQUIREMENT FOR TETRA SYSTEMS. ADVANCES IN AUDIO TECHNOLOGY IN NEW MOTOROLA TETRA PORTABLES WILL IMPROVE THE SAFETY AND EFFECTIVENESS FOR ALL USERS.

In Public Safety and Mission Critical operations the users in the field rely on effective communications for their safety and effectiveness. Even small errors in a voice call at a critical moment can be expensive or worse. So both ends of the voice link need to be able to clearly understand each other. In a TETRA radio this means that both the microphone and speaker systems need to be engineered to exceptional performance without compromising battery life, or the cost, size or weight of the radio. The new generation of Motorola TETRA portables take advantage of new technologies as well as advanced digital processing to offer a step improvement in all aspects of audio performance.

GETTING GREAT AUDIO IN A SMALLER AND LIGHTER RADIO REQUIRES OUT OF THE BOX THINKING AND USING COMPONENTS THAT ARE NOT OFF THE SHELF. THE NEW INTERNAL SPEAKER IS A CUSTOM BUILD PART, DESIGNED FOR OPTIMUM SOUND QUALITY AND MINIMUM WEIGHT.



## WHITE PAPER

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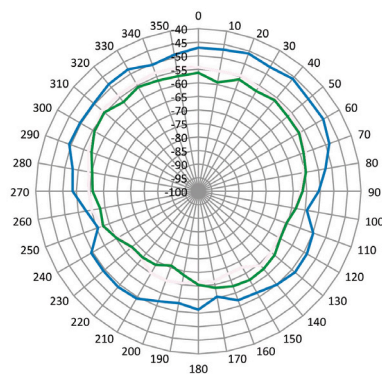
### MEASURED AUDIO DIRECTIVITY PATTERN

Note the significantly improved all-round audio, particularly to the rear

Polar plot, rotate in horizontal angle,  $\Phi$   
Signal : 500Hz



DIRECTIVITY PATTERN AT 500Hz (HORIZONTAL)



Other Radios  
MTP3000 Series

## AUDIO POWER IMPROVEMENTS

A balance has to be achieved in the volume of the audio out of the radio, and the clarity. The new Motorola radios offer both, with a maximum volume which can punch through very loud background noise as well as improved clarity which makes the speech easier and more comfortable to understand against background noise.

The specific techniques used to make these improvements include the following:

**Increased voltage Audio Power Supply for enhanced audio quality.** Motorola's increased voltage Audio Power Supply gives unsurpassed audio quality by ensuring all power amplifiers are never stressed to their limit.

The new side connector benefits from the increased voltage Audio Power Supply as well, to drive the attached accessories with increased peak voltage, without clipping from the Power Amplifier. Comparable performance is obtainable between accessories and internal speaker.

**New audio power amplifiers** are able to sustain a continuous 2W RMS to the internal speaker or to the accessory connected to the side connector. Coupled with 4W of peak power this ensures loud clear audio with excellent speech intelligibility.

**Improved audio in all directions.** Polar Radiation Plots on existing radios shows uneven radiation patterns resulting in non-optimum sound when the radio speaker is not directly facing the listener. A new design of audio port code named slimport provides much improved polar radiation performance in the new radios.

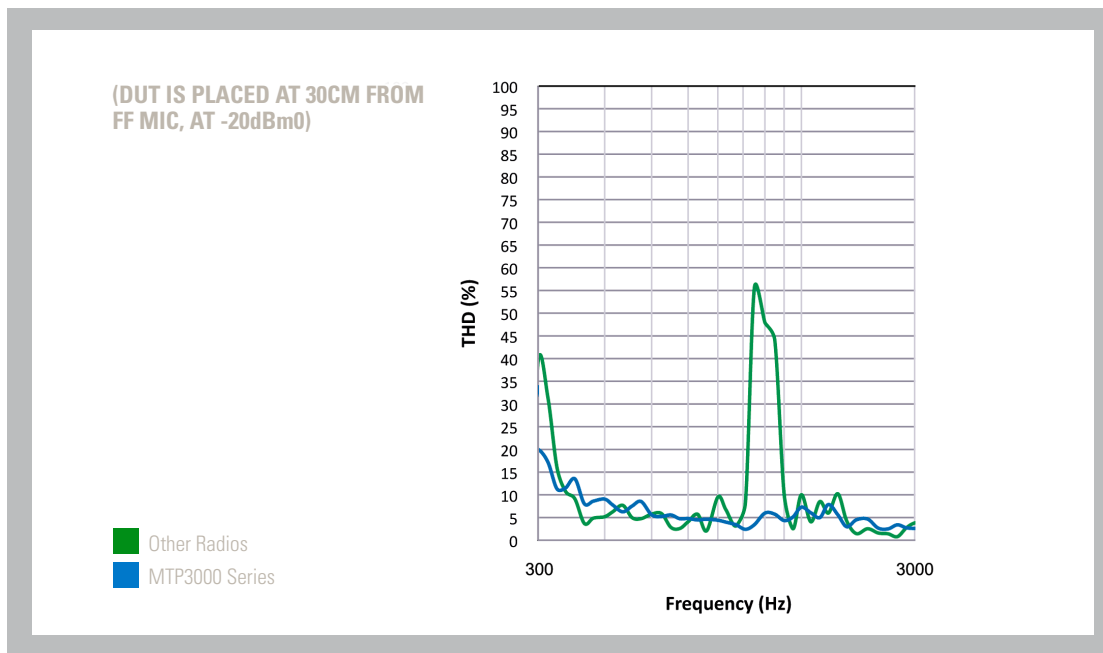
**The slimport design is optimised with several goals in mind.**

1. Building an energy efficient speaker system.
2. Getting a clean sound without rattling and without distortion that originates from the radio mechanics. With the current radios the sound has to come through the keypad and so some reduction in clarity is inevitable.
3. Better radiation for a better audio experience when using the radio in sub-optimum positions (i.e. shoulder or belt worn).

The diagram above demonstrates the improvement in audio output.

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Significant improvements in Total Harmonic Distortion (THD) have been achieved at almost all frequencies, including the important middle range.

**Linearity** is a key performance for sound quality and a necessity for good quality full duplex calls. The entire audio path has been optimised to make sure linearity is retained all the way from minimum to full power, giving low distortion and zero compression. Linearity is also important to get the best possible crest factor from the system, keeping the peaks in the speech signal as intact as possible.

The effect of linearity is shown most clearly in terms of Total Harmonic Distortion. The diagram above shows the comparison of the new radio with other radios.

**Microphone High Pass-Filter.** Imagine the engine rumble in the car cabin or even inside a fire truck. Motorola radios are being used in harsh environments on a daily basis and we have optimised the new microphone path with enhanced high-pass filters to filter out the deep low frequency rumble of an engine, thereby making sure the important speech signal gets through undistorted.

**Microphone with high dynamic range.** High dynamic range microphone ensures that communication is still possible (good quality and without saturation) in extreme noisy conditions.

**Wind noise reduction.** Microphone Bypass Porting for reduced wind noise (up to 10dB improvement compared to traditional design).

**63-tap FIR filter.** To improve the frequency response even more, the new radios feature a 63-tap FIR-filters. Now enabling us to tailor fit the frequency response even better to our customers need. Previously a 29-tap FIR filter was used.

**Dynamic Tx AGC.** The wide range dynamic Tx AGC eliminates the need for Audio Profiles.

**Audio Boost.** The radio can be set to increase volume beyond the normal levels if the user needs this. There will be some reduction in clarity but the maximum volume will be so loud that the radio could be heard by a group of around 10 to 20 people. Clearly this feature will only be needed by users in some specific situations but nevertheless will be of great value in these circumstances.

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# THE COMBINED RESULT

The human ear is an imprecise method of comparison, however the following conclusions are the results of tests which are as fair as possible. The new radios are compared with other TETRA radios.

A series of "Blind" tests were held with over 50 people, and the overwhelming result was that the new Motorola radio was the clearest and best.

A similar test was held in a roadside location with heavy traffic. Once again the new Motorola radio was clearer.

In another outdoor test of volume the new radio was compared with other existing radios. The improvement in volume was so significant that it was found that the radio could be used to address groups of up to 20 people.

All of this evidence is best verified with actual demonstrations to potential users in their environment. Motorola is ready to offer such demonstrations. Please contact your local Motorola representative.

## WHAT THE USERS SAY

SERVITRON, MEXICO

**"EXCELLENT AUDIO, AMAZING QUALITY ON THE AUDIO".**

EMO, NETHERLANDS

**"CLEARLY BETTER AUDIO THAN THE COMPETITION.**

**THE AUDIO WAS OUTSTANDING THROUGH THE RADIO AND THE ACCESSORIES".**

**"THE INTELLIGENT MICROPHONE MAKES A CLEAR DIFFERENCE FOR USERS RECEIVING COMMUNICATION".**

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For more information on the full range of our solutions, please visit us on the web at:

[www.motorolasolutions.com/tetra](http://www.motorolasolutions.com/tetra)

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