PMK–2

PORTABLE MASKING KIT

User Manual

Research Electronics International, LLC

Portable Masking Kit 2 (PMK-2) Case Contents

1. Two Voice Masking Generator (VMG)
2. Charging cables, adhesive strips, alcohol prep pads
3. Audio cables
4. Charging block
5. Four transducers

PMK-2

Portable Masking Kit User Manual

This document is intended to provide guidance and instruction on using the Portable Masking Kit to protect against acoustic leakage vulnerabilities by injecting covering sound to interior room surfaces.

NOTE: The PMK does not offer protection from recording or transmitting devices located within the perimeter; the PMK only protects against structure-bound audio leakage. REI recommends thorough countermeasures sweep accompanied by a physical search to be performed before the installation of the PMK system and periodic sweeps thereafter (for permanent installations) to ensure the integrity of the protected environment.

This manual contains proprietary information intended solely for use with the PMK product.

The overall effectiveness of this product, and of any surveillance countermeasure, is dependent on the threat level and the user's ability to properly use the appropriate equipment.

REI offers the world's largest commercially available Technical Security training facility. Training courses include classroom instruction and hands-on exercises where students perform sweep exercises in "live" environments using target-rich project rooms. The progressive course curriculum is designed for the beginner or the seasoned Technical Security Technician.

Regularly scheduled courses are taught monthly; visit REI's website (www.reiusa.net) or contact REI (sales@reiusa.net) for training dates.

Revision 1

REI products are designed and intended for legal commercial applications. However, because laws and regulations vary from state to state and country to country, it is the sole responsibility of the purchaser and user/operator to check and comply with all applicable laws and regulations for the possession and operation of this equipment before and after making a purchase.

Information contained in this manual including product operation and specifications is subject to change without notice.

Any product or brand names contained in this manual are used only for identification purposes and are trademarks or registered trademarks of their respective holders.

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www.reiusa.net

Table of Contents

⚠ Warnings and Cautions

- CAUTION: Any changes or modifications not expressly approved by REI could void the user's authority to operate the equipment.
- The PMK is for professional use only.
- For your safety do not use the PMK if:
    - The VMG housing is damaged
    - If it is suspected that the unit requires servicing
    - There is damage to the wireless charging frame and frame components
    - Transducer wires are frayed or missing parts
- Only use REI-approved power cables and accessories.
- Equipment is to be serviced by the manufacturer only. There are no serviceable parts inside. Contact your dealer or Research Electronics International, LLC for repairs. Opening the unit will void the warranty.
- If the equipment is used in a manner not specified in this manual, the protection of the equipment may be impaired.
- For your safety do not charge or use if:
    - The cable or wires become frayed or otherwise damaged.
- Do not charge with case lid closed.

FCC

The Portable Masking Kit complies with part 18 of the FCC rules.

Introduction

Portable Masking Kit Overview

REI's Portable Masking Kit is intended to provide voice privacy via audio masking. It is intended to mask acoustic leakage from a meeting room with a cover of voice audio delivered through the room surfaces (walls, windows, ductwork, etc.) to protect room voice privacy vulnerabilities. Pre-recorded audio files can be used, or meeting participants' voices can be recorded and played back as masking sounds. See p. 15 for more on recording participant voices.

Product Cleaning and Maintenance

To prevent electrical shock, power down the Voice Masking Generator. Wait at least 10 seconds for the unit to fully discharge to prevent electrical shock. Clean the housing with a small amount of ethyl alcohol or a neutral detergent. Exercise caution when handling hazardous chemicals. For general cleaning and decontamination, use a cloth damp with a mild soap solution. For more thorough decontamination, a small amount of 70% isopropyl alcohol can be used. Transducers can be cleaned using the same methods.

Portable Masking Kit Description

General

Acoustic Eavesdropping

Acoustic eavesdropping is a privacy threat method of intercepting and monitoring conversations by picking up the vibrations of sound waves on surfaces such as walls, glass, and doors. Sound vibrates these surfaces, and a contact microphone can pick up these vibrations and transmit the information along wires or modulate it onto radio waves to be received by an unwanted listener outside the room. Laser and microwave beams reflected off these surfaces are modulated with the information and pose the same threat.

Additionally, vibrations caused by talking in a room can be transferred along air ducts, plumbing, walls, ceilings, etc. These vibrations can be intercepted and monitored by persons several floors or rooms away. This means that even though a room has been cleared of eavesdropping devices, the voice information from within that room may still be vulnerable.

The PMK system combats this by setting up a perimeter of masking sounds that create a sound barrier to disrupt voice leakage. The transducers are designed to inject masking voices (or sounds) onto exterior room surfaces to thwart any exterior surveillance attempts.

Description

The Voice Masking Generators generate, amplify, and deliver sound to room perimeter surfaces using the transducers to create a masking sound barrier. This will guard against acoustic eavesdropping and provide a more secure environment for in-person meetings. Custom user-created voice files can also be used to mask meeting participants with their own voices as an additional secure option.

Voice Masking Generators

Product Front

The product front includes a speaker, a power indicator light, and a USB connection light.

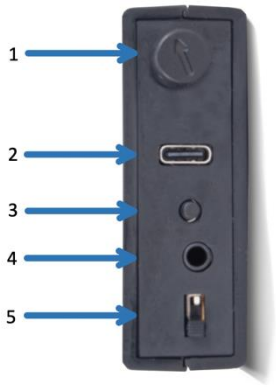
Product Back

The VMG back contains a wireless charging contact and terminal spring wire-clips for wiring to transducers.

Product Top

The top of the VMG contains audio, volume, and power controls:

1) Power/Volume switch
2) USB-C port for charging and data transfer
3) Switch between Primary and Secure folders
4) Line out
5) Three-position switch for controlling sound output

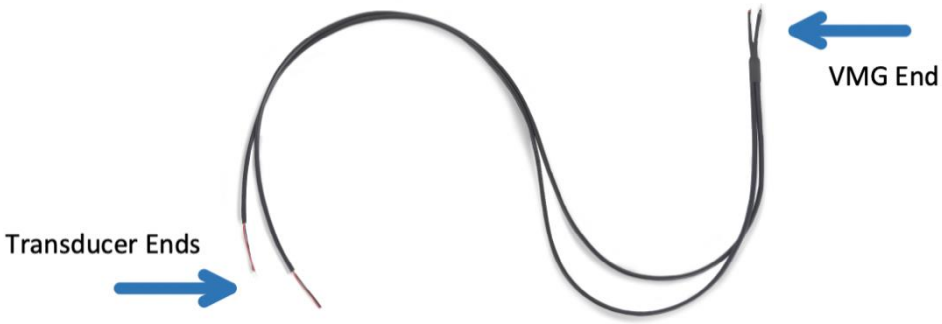


Transducers

The Portable Masking Kit contains 4 transducers. These, together with the 2 VMG units, will deliver sound to room and room surfaces. Each VMG can power and transmit sound to two transducers. Wire the transducers as directed on page 14.

VMG-to-Transducer Wiring

The Portable Masking Kit contains pre-assembled audio wiring for connecting the VMG to two transducers. While VMGs can be used without transducers, the PMK system is designed to use the transducers for entire-room security. Each kit contains 2 wiring sets.



Voice Masking Generator Operation

Powering On/Off and Volume Control

To power the VMG, press down the Power/Volume switch. The power indicator's light will turn green. To power off, press the switch again. For volume control, twist the knob clockwise to increase volume and counterclockwise to decrease.

Storage and Transport

The Portable Masking Kit has been designed for secure storage and transport of the VMG units and their accessories. Place contents in their appropriate slots and pockets (see Case Contents page), then close and latch case.

Charging

The Portable Masking Kit comes with two USB-A to USB-C charging cables and a wall charger with two USB-A ports.

1) Insert the USB-C end of the charging cable into the VMG (top of unit) *
2) Insert the USB-A end into the REI-supplied wall adapter
3) Plug wall adapter into power outlet

Do not charge units in a closed case as this can damage the charging cable and lead to overheating of the VMG.

A steady battery light indicates charging. The light will turn off when a full charge is reached.

Generating sound with VMGs

Using Built-In VMG Sounds

The Portable Masking Kit VMGs come with two sounds: one, labeled **"Primary,"** is the default sound played and contains 10 hours of HVAC-like sounds. This will loop and play repeatedly as long as the battery lasts or indefinitely if the VMG is connected to power. The **Primary** sound is played by default.

A second sound labeled **"Secure"** contains 10 hours of mixed voices. This sound will also loop (same as the **Primary** sound). It can be selected by pressing the ***Secure*** button located at the top of the VMG. If the unit is powered down, **Secure** must be selected upon each power-up using the ***Secure*** button.

Using Custom Voices

VMGs can also be used to deliver user-created custom mixed-voice sound. These custom files can provide additional security by masking meeting participants with their own voices. See p.15 for more on voice security and how to create these files.

Load user-created sound files (WAV or MP3) using the following procedure for Windows OS:

1) Turn the VMG on by pressing the power/volume button
2) Connect the VMG to computer using the USB-A to USB-C cable

3) Select either the ***Primary*** or ***Secure*** folder
4) Open the folder
5) Move the current file to the computer or to the VMG's ***Files*** folder (for future use if desired)
6) Place the user-supplied sound file in the desired either ***Primary*** or ***Secure*** folder
7) Disconnect and test the new sound file

For MacOS users: Follow the above procedure for Window OS with an additional final step of removing hidden files* using a Windows OS computer:

1) Connect VMG (loaded with custom sound files) to a Windows OS computer
2) In Files option, turn on hidden files
3) For Primary and/or Secure folder, delete any files that contain "._" in the filename

**MacOS places hidden extended attributes files within the VMG folder that cannot be played by the VMG and must be removed for sound file looping to occur.*

Selecting VMG output

There are three options for VMG sound output: internal speaker, external speaker (transducer) and both internal and external. Access these using the three-way output switch located at the top of the VMG. The middle position will select both the speaker and transducers.

Deployment of Portable Masking Kit

The PMK uses a combination of Voice Masking Generators (VMGs) and their connected transducers placed strategically throughout a target area to create masking noise that covers private conversations from eavesdropping.

Installation

For PMK set-up, transducers can be applied to surfaces with Command™ Medium Refill Strips. These are included in the PMK kits and replacements can be purchased from: https://www.command.com/3M (QR code links to US retail website) See p. 14 for installation instructions. Alcohol prep pads can be used to degrease appropriate surfaces before applying strips.

3M Adhesive Link

Effective Placement of Transducers and VMGs

Determine the placement of transducers using the guidelines below:

Walls – Place transducers 4 – 5 feet apart, centered between floor and ceiling. Center the VMG between the pair (these can also be attached using the 3M strips).

Windows – One transducer placed on each pane of glass.

Doors – One transducer (or VMG) placed on each door.

Note: "Shielded Screen Rooms" are shielded against R.F. devices transmitting out of the room, but not necessarily against acoustic leakage.

Transducers are more effective on some surfaces than others. The TSCM technician should be familiar with how these surfaces transmit sounds as well as potential vulnerabilities posed by room features such as ductwork, vents, door openings, and external windows.

Materials effective for sound conduction from mounted transducers:

- acrylic glass (Plexiglass) or polycarbonate glass
- glass windows
- acoustic drop-ceiling tiles
- wallboard/drywall
- plywood/MDF/OSB sheets

Materials less effective for sound conduction from mounted transducers :

- metal panels
- metal structural members
- concrete
- wooden beams

Mounting Transducers and VMGs

Each transducer and VMG unit can be attached to surfaces with the included 3M Command ™ adhesive strips. Follow the manufacturer's instructions for attachment and removal. (See p. 13).

The following materials are suitable for adhesion using this method:

- painted walls
- finished wood
- glass
- tile
- metal
- other smooth surfaces

Examples of unsuitable surfaces are:

- wallpaper
- brick
- rough surfaces
- non-stick surfaces

Transducers placed 4–5 ft. apart with transducer wires attached to VMG:

Wiring Transducers to VMG

After fastening transducers and VMGs to the room surfaces, connect the transducers to the VMGs using the included transducer wiring. There are 2 transducer connecting wires each with one wire pair at one end for connecting the VMG and the other end with two wire pairs for connecting to two transducers. The VMG and transducers both use terminal spring wire clips for attachment.

1) Press the terminal spring clip to allow for insertion
2) Insert wire
3) Release terminal spring clip to secure wire

To disconnect wires, press the terminal clip, and pull out the wire.

Test the System

When the transducers and VMGs are placed in the room, turn on both units. It is preferable to use different start times to cover any gaps during looping. After the system is powered on and generating the desired sound (see p. 11), check external surfaces for acoustic vulnerabilities and confirm they are covered by the selected masking sounds.

Creating Custom Voice-masking Files with Audacity

Purpose and Use of Voice Files

The Voice Masking Generator contains two masking sound files contained in a Primary and a Secure folder. The default sound is simulated HVAC and is considered pink noise. However, it can be desirable to create voice-masking files optimized specifically for the environment, language, and individuals who will be talking within a room protected by the PMK system. These files can be created by using the free downloadable software available from Audacity. This operation of the PMK's Voice Masking Generator was prepared using Audacity version 3.4.1 It is recommended to use this version.

Assess Hardware Before Recording

When using an external microphone, it should be plugged into the computer before starting Audacity, or else there may be no options given for the mono-versus-stereo setting when setting preferences. Even for computers with built-in microphones, *it is recommended to use an external microphone* for better recording quality. It is preferable to use a USB connection rather than an audio jack port. Not all audio jack ports are capable of receiving microphone input. If Audacity does not recognize an external microphone, please do the following:

www.audacityteam.org

1) Under **Audio Setup** select ***Rescan Audio Devices***

2) Under **Audio Setup** select ***Recording Device,*** then select ***External Microphone***

Creating Voice Masking Files with Audacity Software

Prepare for the Recording

Select individuals for voice recording based on which voices are the most critical to protect. Select at least three voices of which 1/3 are female (ideally) and include a range of voice types. Suggested combinations are:

- 3 voices: 1 female, 2 male
- 4 voices: 1 female, 3 males ***or*** 2 female, 2 male
- 5 voices: 2 female, 3 male
- 6 voices: 2 female, 4 male, ***or*** 3 female, 3 male

After selecting the voices, choose the reading material. News articles unrelated to the meeting subject are ideal. Record each voice for at least 5 minutes. (See section on recording voices on p. 18)

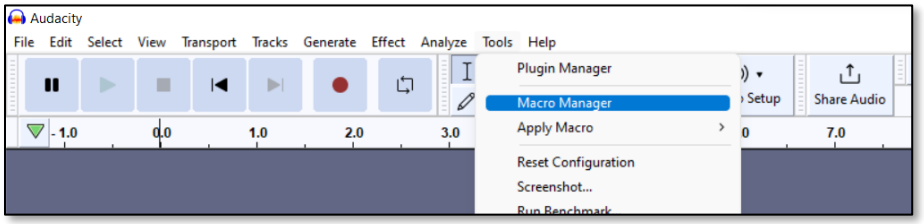
Check to see the audio recording capabilities of the computer to be used. For computers without a built-in microphone, an external microphone should be plugged in before starting Audacity. Failure to do this will cause an error at startup with Audacity software. Please note: an external microphone is recommended for best recording quality.

Install and Configure Audacity

1) Download Audacity, available for free: www.audacityteam.org (see p. 15 for QR code)
2) Download the ***Voice Mixing Macro*** file: *

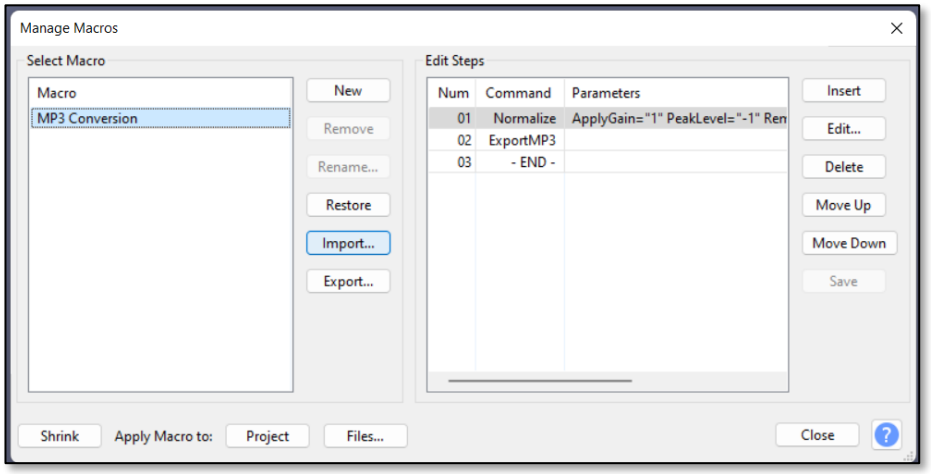
Voice Mixing Macro Zip File

3) Load the ***Voice Mixing Macro*** by doing the following:
    a. In the application **Tools**, select the ***Macro Manager***



b. In **Macro Manager**, select ***Import Macro***
c. From the popup box, select the macro file to import
d. Close Macro Manager

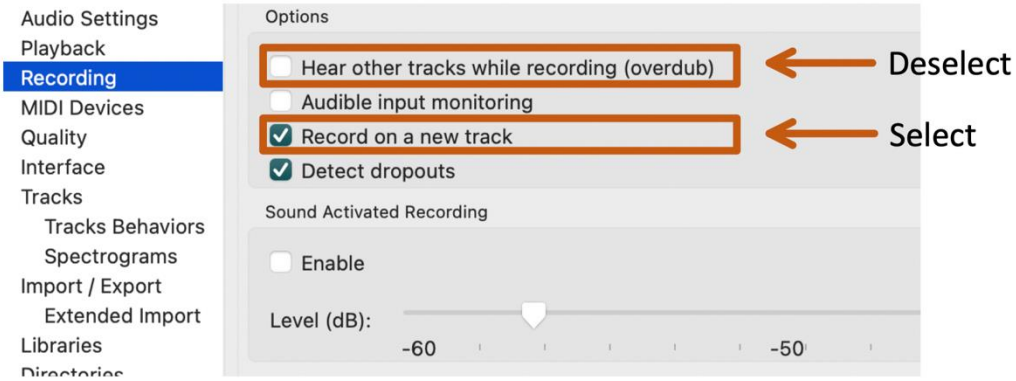
**For situations where downloading the Voice Mixing Macro file is not possible, please see p.26 for copying and importing the Macro text file to Audacity.*



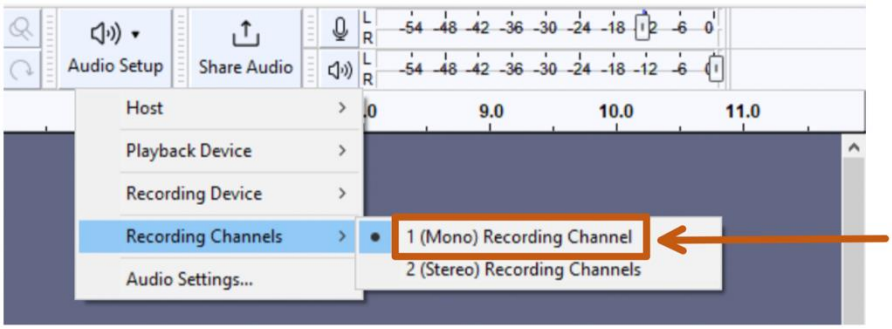
Set Audacity Preferences

Before making any recordings, please make these changes in **Preferences**. These will only need to be set once at the initial startup.

1) Under **Edit** (in the menu bar), select ***Preferences***
2) Within **Preferences** select ***Recording***
3) Deselect "***Hear other tracks while recording (overdub)***"
4) Select ***"Record on a new track"*** (leave other defaults as they are)
5) Select "***OK***" to save changes to **Preferences**



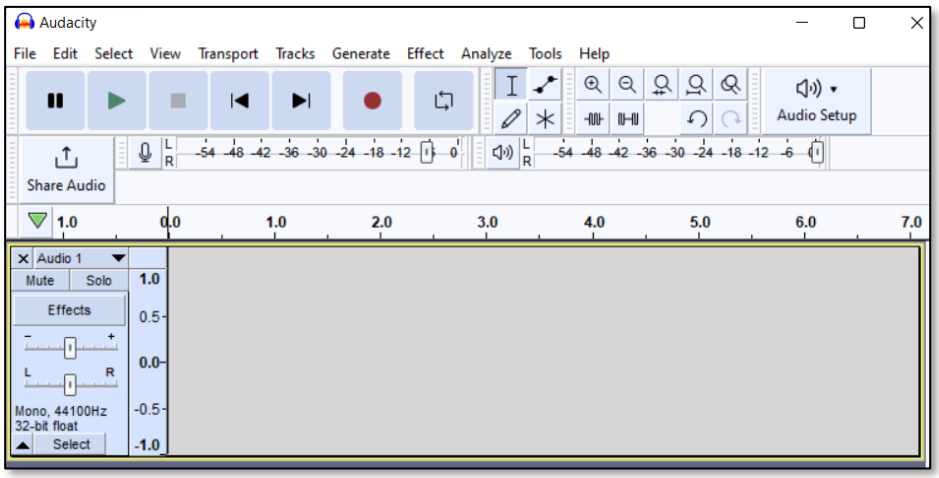
6) In the Toolbar, select ***Audio Setup***
7) In the dropdown menu, select ***Recording Channels***
8) From the options, select ***1 (Mono) Recording Channel***



*Note: For Mac computers, this will be slightly different for steps **1** and **2: Audacity** (in the menu bar)*
Preferences → Recording

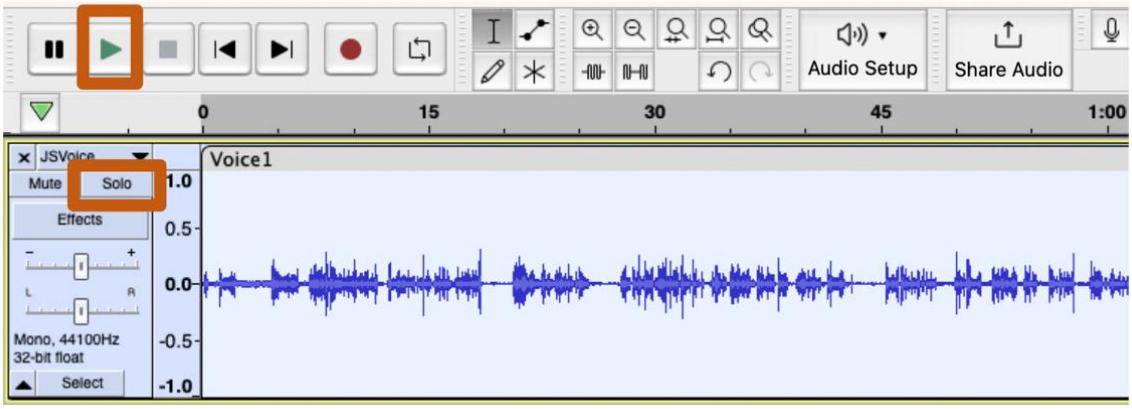
Record Voice Files

When the readers are prepared, with Audacity open and with preferences set (p. 17), begin recording. Please ensure over 5 minutes are recorded per reading. The screen should appear like this:



1) When the reader is ready, select record 
2) Have the reader at their normal conversational pace and volume
3) Stop the recording at 5+ minutes
4) Repeat steps **2–4** for all remaining readers

5) Verify each track by selecting ***Solo*** and then selecting ***Play***



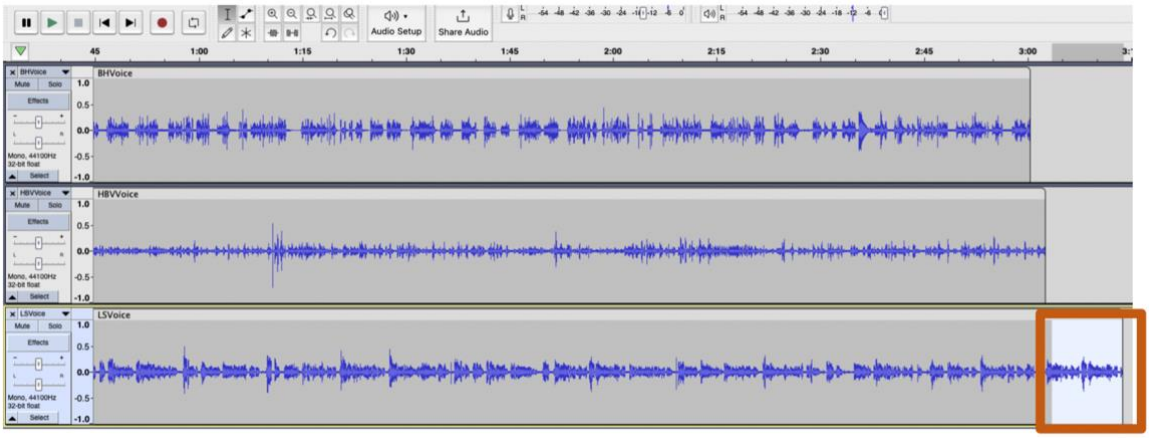
Note: Before mixing the recorded files, they should be exported and stored for future use. (See page 22.) The Voice Mixing Macro will permanently alter the recordings.

Trim and/or Lengthen Tracks

The track lengths may need to be adjusted. Trim any tracks that are too long or lengthen tracks that are too short. While tracks do not need to be identical in length, they should be as close as possible. The Voice Mixing Macro will create a new track the length of the longest track.

If a track is too long, highlight the portion of the track that is to be trimmed:

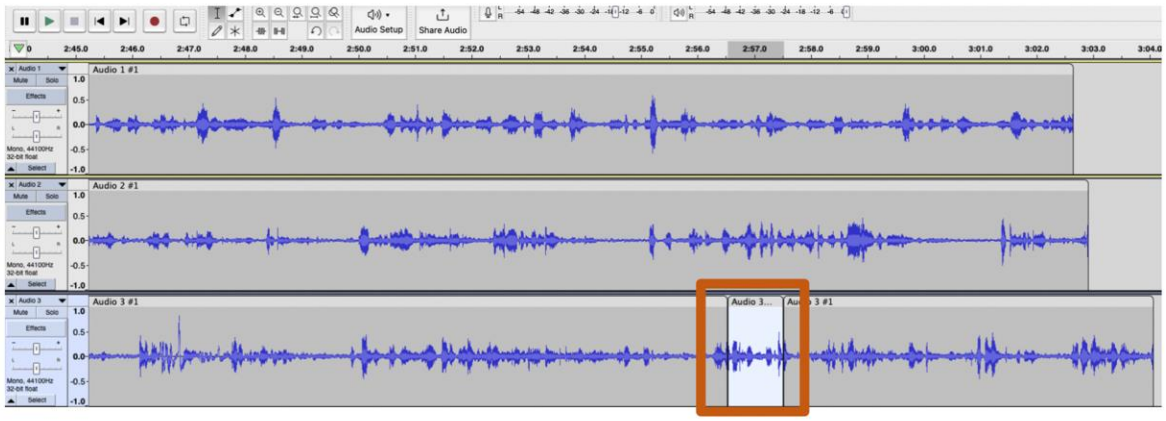
1) Using the cursor, click and drag to highlight the portion of the track to be removed
2) Click ***Delete*** to remove portion to be trimmed



To lengthen a track that is too short:

1) Using the cursor, click and drag to highlight the portion of the track to be copied.
2) Select “copy” by a right-click
3) Insert within the recording by clicking inside the recording
4) Right-click and select “paste”

5) Paste the copied track anywhere within the track (there is no need to join clips after pasting)

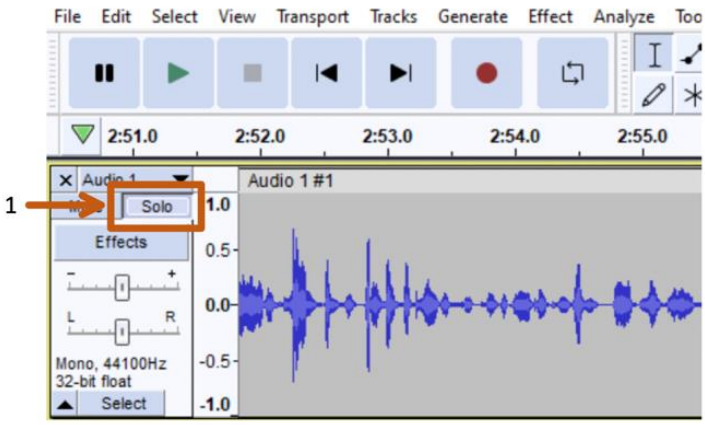


Note: It is not advised to significantly lengthen the track by this method. Lengthening by copy/paste should only be used for small adjustments. It is preferable to make each recording at least 5 minutes or more.

Export and Save Original Recordings

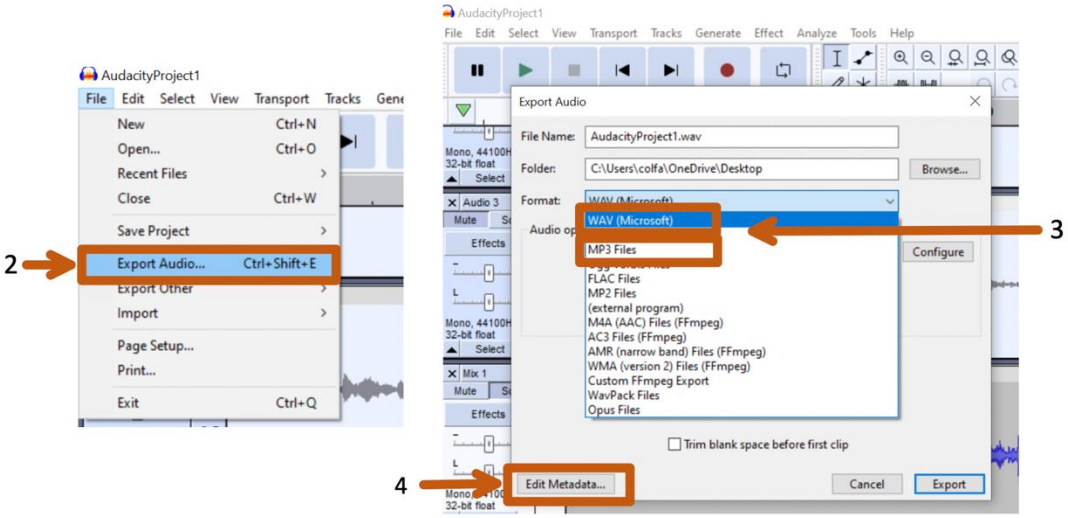
It is recommended to export and save these voice recordings before applying the Voice Mixing Macro. These recordings can be used in the future (see p. 22). The Voice Mixing Macro will alter the tracks irreversibly. Exporting and saving these individual unmodified tracks will allow them to be used for future mixing. Export and save by:

1) Select ***Solo*** for the track to be exported (this will ensure only one track is saved)

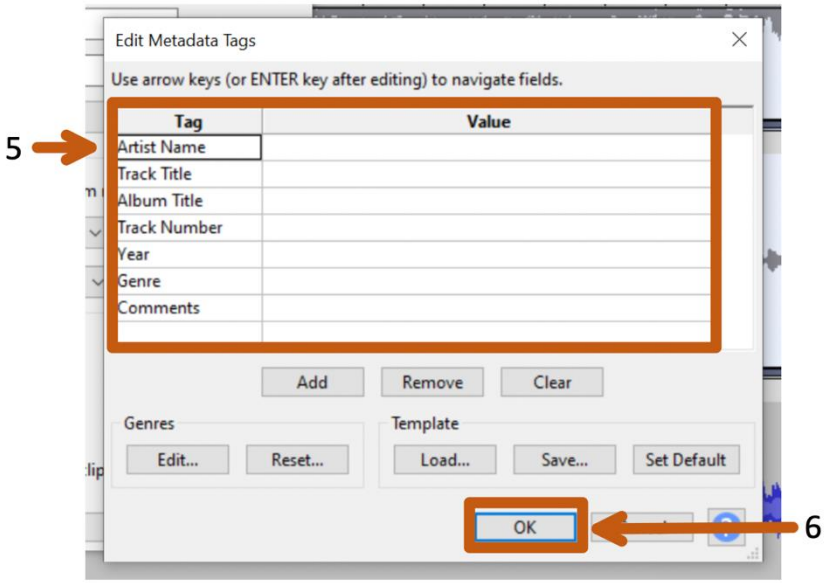


2) Under **File**, select ***Export Audio***
3) Select ***MP3*** or ***WAV*** format

4) Update the metadata (for future reference) by selecting ***Edit Metadata***.



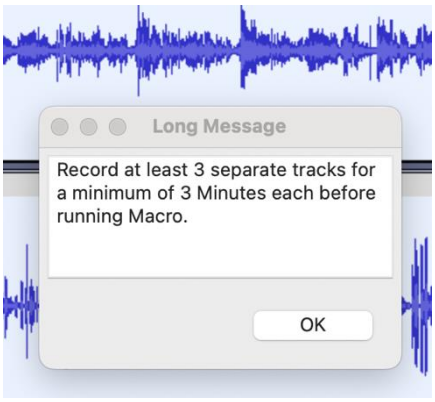
5) In the popup box, edit *Metadata Tags*
6) Select ***OK***



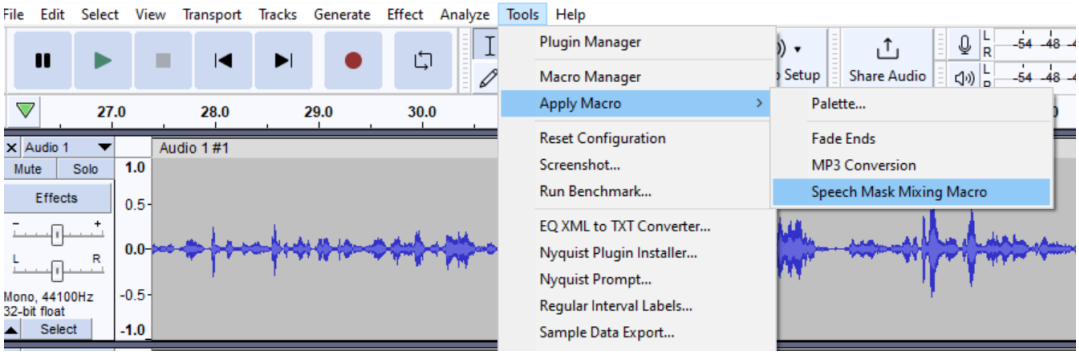
Create the Voice Masking Track

REI provides a **Voice Mixing Macro** that will select all recorded tracks for mixing, balance the levels, adjust noise, and add echoes. These echoes will fill any potential dead space between words. All the tracks will be mixed, and a new single track will be generated. The mixed track will be the last track at the bottom of the screen. This mixed track can be exported as an MP3 or WAV file and saved.

1) Under the **Tools** menu, select ***Apply Macro***
2) From the options, select ***Voice Mixing Macro***
3) A reminder will appear regarding track number and length. This message will display regardless of track length



4) Select ***OK***
5) Confirm mix by selecting ***Solo*** (left of new track) and then ***Play*** (new track is located at the bottom)
6) Export this voice mix as an ***MP3*** or ***WAV*** file
7) Save the file



Note: the VMG only recognizes MP3 or WAV format files. Other formats are not recognized.

Strategies for Creating Files for Voice Protection

After recording new voices and before mixing them with the Voice Mixing Macro, it is good practice to save them. This can become the foundation of a voice file library. Saved voice files can be used to be mixed in the future and custom mixed tracks can also be saved and used in this way. Please remember that these must be saved in MP3 or WAV format for the **Voice Masking Generator**.

For a meeting, each voice to be protected can be mixed with other voices present, or with single previously recorded tracks. For each mix, a minimum of 3 voices should be used. If there are less than 3 voices to be protected, then mix the two voices with one pre-recorded voice or record a volunteer's voice.

Specifications

VMG

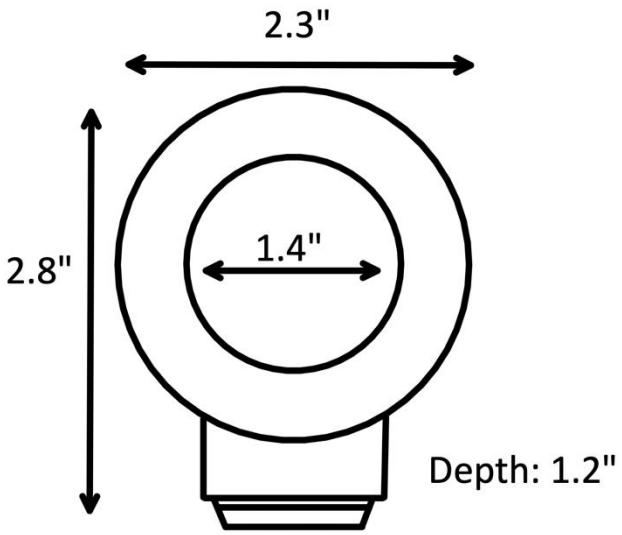
Specification	Value
Unit wired power/charging/programming port	USB-C @ 5 V, 1 A
Battery:	18.5 Wh Li-Ion
Battery life (typical)	½ level, no transducers: 50 h ½ level, 2 transducers only: 36 h ½ level, 2 transducers + internal speaker: 33 h full level, no transducers: 20 h full level, two transducers only: 9 h full level, two transducers + internal speaker: 8 h
Typical charge time	9 h (wireless), 8.5 h (wired)
Audio output	Internal speaker and push terminal line out
Line out amplitude	1 V pk-pk
Audio frequency range	100 Hz – 12 KHz
Unit dimensions	4.6 x 2.6 x 0.9 in
Unit weight	5.7 oz / 160 g
Case dimensions	10.5 x 9.5 x 4.75 in / 16 x 38 x 47 cm
Input voltage	5.0 V dc (1 A max)
Case/contents weight	4.9 lbs
Battery charging temperature	0 to 24 °C (wireless), 0 to 40°C (wired)
Storage temperature	-20 to 60 °C
Operating temperature	-10 to 40 °C

CE

Transducer

Specification	Value
Dimensions*	2.8 x 2.3 x 1.2 in
Impedance	4 Ω
Power handling (RMS)	20 W
Frequency range	20Hz – 20 kHz
Weight	3.3 oz

*Dimension Illustration



Glossary

Acoustic drop-ceiling tiles: Ceiling tiles designed to improve the acoustics of a room by absorbing sound.

Acoustic Eavesdropping: A privacy threat method of intercepting and monitoring conversations by picking up the vibrations of sound waves on surfaces such as walls, glass, and doors.

Audacity: A free, open-source digital audio editor and recording application software.

Macro: A set of instructions that can be executed automatically to perform a specific task.

Metadata: Data that provides information about other data.

RMS (Root Mean Square): A measure of the magnitude of a varying quantity, such as an alternating current or sound wave.

SPL (Sound Pressure Level): A measure of the intensity of sound, expressed in decibels (dB).

Terminal spring wire clip: A type of electrical connector that uses a spring-loaded mechanism to securely hold a wire in place.

Transducer: A device that converts one form of energy into another. In the context of the PMK, transducers convert electrical energy into sound energy.

TSCM (Technical Surveillance Countermeasures): The process of detecting and preventing the interception of sensitive information by unauthorized parties.

VMG (Voice Masking Generator): A device that generates, amplifies, and delivers sound to room perimeter surfaces using transducers to create a masking sound.

Resources

Audacity Link

www.audacityteam.org
Version 3.4.1 recommended

Adhesive

https://www.command.com/3M/en_US/p/d/cobnaw017079/
3M Command™ Medium Refill Strips

Voice Mixing Macro File

For situations when it is not possible to download the Voice Mixing Macro via the Internet, please take these steps:

1) Copy the text exactly as written below, beginning with 'Message' and ending with '"UsePeak="0"'
2) Place this in a text document (e.g. MS Word). Save as a .txt (plain text file)
3) Import this file into Audacity **Macro Manager**, following the instructions on p. 16

Voice Mixing Macro file link

Message:Text="Record at least 3 separate tracks for a minimum of 3 Minutes each before running Macro."
SelectAll:
LoudnessNormalization:DualMono="1" LUFSLevel="-16" NormalizeTo="0" RMSLevel="-3" StereoIndependent="0"
MixAndRenderToNewTrack:
RemoveTracks:
SelectAll:
Echo:Decay="0.3" Delay="0.7"
Limiter:GAIN-L="0" GAIN-R="0" HOLD="5.9" MAKEUP="No" THRESH="-5" TYPE="SoftLimit"
Compressor:AttackTime="0.1" NoiseFloor="-40" Normalize="1" Ratio="8" ReleaseTime="1" Threshold="-24" UsePeak="0"