

# **Sound Generation**

## *User Manual*

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- I. Creating a pure tone
- II. Creating broadband noise
- III. Creating a range of tones
- IV. Creating narrowband noise
- V. Loading .wav files
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# I. Creating a Pure Tone

1. Under CREATE, check the box that says 'Pure Tone'.
  - Make sure that there are no other boxes checked!
2. Enter a number in kHz for the frequency of the tone in the box that says 'Constant Freq' under PARAMETERS.
3. Enter the duration of the tone in milliseconds in the box titled 'Duration' under PARAMETERS.
4. Enter the number of iterations in the 'Repeats' box. If only presenting the stimulus one time, enter '1'.

The image shows a screenshot of the 'Stimulus Generator GUI' with several red arrows pointing to specific fields, each labeled with a step number. The GUI is divided into sections: 'CREATE' and 'PARAMETERS'. In the 'CREATE' section, the 'PURE TONE' checkbox is checked. In the 'PARAMETERS' section, the 'Constant Frequency' field is set to 5 kHz, the 'Duration' field is set to 200 ms, and the 'Repeats' field is set to 5. The 'GENERATE' button is visible at the bottom right, and the 'FOR SAVING' field at the bottom shows 'PureTones1'.

**Stimulus Generator GUI**

UPLOAD

**CREATE**

- ☐ RANGE OF TONES
- ☒ PURE TONE
- ☐ BROADBAND NOISE
- ☐ NARROWBAND NOISE
- ☐ VARIOUS RANGES

**PARAMETERS**

Frequency Range:  ~  kHz

Bandwidth:  kHz ☐ Octaves

Steps:  ☐ Force steps

Constant Frequency:  kHz

SAM:  ~  Hz ☐ VARY

Duration:  ms

ISI:  ms

Repeats:

☐ RANDOMIZE

GENERATE

CLEAR

PLAY

FOR SAVING:

**Step 1: Check PURE TONE**

**Step 2: Enter frequency**

**Step 3: Enter duration**

**Step 4: Enter iterations**

## Additions:

- To *modulate the amplitude* of tone, enter a number in Hz in the first box titled 'SAM'.
- To vary the amplitude modulation within a range, enter the low number in the first box and the high number in the second box.
  - Check the 'VARY' box next to SAM.
  - See more on amplitude modulation in section VI.
- If you have multiple iterations of the stimulus, you might want to add an *ISI* between each iteration.
  - Enter a number in milliseconds in the ISI box.
- To randomize the presentation of multiple stimuli, check the 'Randomize' box next to the 'Generate' button.

The image shows a web-based interface titled "Stimulus Generator GUI". It contains several sections: "CREATE" with radio buttons for "RANGE OF TONES", "PURE TONE" (selected), "BROADBAND NOISE", "NARROWBAND NOISE", and "VARIOUS RANGES"; "PARAMETERS" with input fields for "Frequency Range" (two boxes with a tilde), "Bandwidth" (two boxes with a tilde), "Steps" (one box with a tilde), "Constant Frequency" (one box), "SAM" (two boxes with a tilde), "Duration" (one box), "ISI" (one box), and "Repeats" (one box); and a "RANDOMIZE" checkbox. At the bottom are "GENERATE", "CLEAR", and "PLAY" buttons, and a "FOR SAVING:" label with a text box containing "PureTones1". Two red arrows point from text labels to the interface: "Amp. Mod." points to the "VARY" checkbox next to the "SAM" fields, and "ISI" points to the "ISI" input field.

**Stimulus Generator GUI**

UPLOAD

**CREATE**

☐ RANGE OF TONES

☒ PURE TONE

☐ BROADBAND NOISE

☐ NARROWBAND NOISE

☐ VARIOUS RANGES

**PARAMETERS**

Frequency Range:  ~  kHz

Bandwidth:  kHz ☐ Octaves

Steps:  ☐ Force steps

Constant Frequency:  kHz

SAM:  ~  Hz ☒ VARY

Duration:  ms

ISI:  ms

Repeats:

☐ RANDOMIZE

GENERATE

CLEAR

PLAY

FOR SAVING:  PureTones1

Amp. Mod.

ISI

## II. Creating Broadband Noise

**Stimulus Generator GUI**

UPLOAD

**CREATE**

☐ RANGE OF TONES  
☐ PURE TONE  
☒ BROADBAND NOISE  
☐ NARROWBAND NOISE  
☐ VARIOUS RANGES

**PARAMETERS**

Frequency Range:  ~  kHz

Bandwidth:  kHz ☐ Octaves

Steps:  ☐ Force steps

Constant Frequency:  kHz

SAM:  ~  Hz ☐ VARY

Duration:  200 ms

ISI:  ms

Repeats:  3

☐ RANDOMIZE

GENERATE

CLEAR

PLAY

FOR SAVING:  BBnoise1

Step 1: Check  
BROADBAND NOISE

Step 2: Enter duration

Step 3: Enter iterations

## Stimulus Generator GUI

UPLOAD

### CREATE

- ☐ RANGE OF TONES  
☐ PURE TONE  
☒ BROADBAND NOISE  
☐ NARROWBAND NOISE  
☐ VARIOUS RANGES

### PARAMETERS

Frequency Range:  ~  kHz

Bandwidth:  kHz ☐ Octaves

Steps:  ☐ Force steps

Constant Frequency:  kHz

SAM:  4 ~  8 Hz ☒ VARY

Duration:  200 ms

ISI:  250 ms

Repeats:  3

☐ RANDOMIZE

GENERATE

CLEAR

PLAY

FOR SAVING:

BBnoise1

Amp. Mod.

ISI

### III. Creating a range of tones

The image shows a screenshot of the 'Stimulus Generator GUI' with several red arrows pointing to specific fields, each labeled with a step number. The GUI has a title bar 'Stimulus Generator GUI' and an 'UPLOAD' button. Below is the 'CREATE' section with radio buttons for 'RANGE OF TONES' (checked), 'PURE TONE', 'BROADBAND NOISE', 'NARROWBAND NOISE', and 'VARIOUS RANGES'. The 'PARAMETERS' section includes 'Frequency Range' (2 ~ 8 kHz), 'Bandwidth' (kHz or Octaves), 'Steps' (3) with a 'Force steps' checkbox, 'Constant Frequency' (kHz), 'SAM' (Hz or VARY), 'Duration' (200 ms), 'ISI' (ms), and 'Repeats' (1). At the bottom are 'RANDOMIZE', 'GENERATE', 'CLEAR', and 'PLAY' buttons, and a 'FOR SAVING' field with the text 'RangeofTones1'.

**Stimulus Generator GUI**

UPLOAD

**CREATE**

☒ RANGE OF TONES → Step 1: Check RANGE OF TONES

☐ PURE TONE

☐ BROADBAND NOISE

☐ NARROWBAND NOISE

☐ VARIOUS RANGES

**PARAMETERS**

Frequency Range: 2 ~ 8 kHz → Step 2: Enter range

Bandwidth: kHz ☐ Octaves ☐

Steps: 3 ☐ Force steps → Step 3: Enter steps (defaults is octaves)

Constant Frequency: kHz ☐

SAM: ☐ ~ ☐ Hz ☐ VARY

Duration: 200 ms → Step 4: Enter duration

ISI: ☐ ms

Repeats: 1 → Step 5: Enter iterations

☐ RANDOMIZE

GENERATE

CLEAR

PLAY

FOR SAVING: RangeofTones1

\*When entering the range of tones:

- (1) The default is in octaves. If you enter a range that isn't naturally in octaves, it will only play to the last octave. If you choose force steps and enter a number, then the range will be split by the number of steps.
- (2) If you want to repeat an entire range of e.g. 4 tones 3 times, then multiply those numbers and enter 12 in the repeats box.

## IV. Narrowband noise

### Stimulus Generator GUI

UPLOAD

**CREATE**

☐ RANGE OF TONES

☐ PURE TONE

☐ BROADBAND NOISE

☒ NARROWBAND NOISE

☐ VARIOUS RANGES

**PARAMETERS**

Frequency Range:  ~  kHz

Bandwidth:  kHz ☐ Octaves

Steps:  ☐ Force steps

Constant Frequency:  kHz

SAM:  ~  Hz ☐ VARY

Duration:  ms

ISI:  ms

Repeats:

☐ RANDOMIZE

**GENERATE**

**CLEAR** **PLAY**

FOR SAVING:

Step 1: Check  
NARROWBAND  
NOISE

Step 2: Enter range

Step 3: Enter duration

Step 4: Enter iterations



## Stimulus Generator GUI

UPLOAD

### CREATE

- ☐ RANGE OF TONES
- ☐ PURE TONE
- ☐ BROADBAND NOISE
- ☒ NARROWBAND NOISE
- ☒ VARIOUS RANGES

Step 1: Check  
NARROWBAND NOISE

### PARAMETERS

Start Center Freq:  ~  kHz

Step 2: Enter center freq

Bandwidth:  kHz ☐ Octaves

Step 3: Enter bandwidth

Steps:  ☐ Force steps

Step 4: Enter steps

Constant Frequency:  kHz

SAM:  ~  Hz ☐ VARY

Duration:  ms

Step 5: Enter duration

ISI:  ms

Repeats:

Step 6: Enter iterations

☐ RANDOMIZE

GENERATE

CLEAR

PLAY

FOR SAVING:

NBnoise1

## V. Loading .wav files

**Stimulus Generator GUI**

1. Click upload

These GUIs will pop up

2. Select .wav files

3. Add ISI

4. Click Randomize for stimulus randomization

5. Click Broadcast to play stimulus list

The image displays the Stimulus Generator GUI and a file selection dialog. The GUI has an 'UPLOAD' button at the top. Below it are 'CREATE' and 'PARAMETERS' sections. The 'CREATE' section includes checkboxes for 'RANGE OF TONES', 'PURE TONE', 'BROADBAND NOISE', 'NARROWBAND NOISE', and 'VARIOUS RANGES'. The 'PARAMETERS' section includes input fields for 'Frequency Range', 'Bandwidth', 'Steps', 'Constant Frequency', 'SAM', 'Duration', 'ISI', and 'Repeats'. At the bottom of the GUI are buttons for 'GENERATE', 'CLEAR', 'PLAY', 'RANDOMIZE', and 'BROADCAST'. A file selection dialog titled 'Select files' is shown to the right, displaying a list of files with names like '12\_filename.mat' through '1\_filename.mat'. Red arrows indicate the workflow: from the 'UPLOAD' button to the file selection dialog, then to the 'RANDOMIZE' and 'BROADCAST' buttons in the Stimulus Generator GUI, and finally to the 'ISI' input field.

## VI. Saving Data

**Stimulus Generator GUI**

UPLOAD

**CREATE**

☐ RANGE OF TONES  
☐ PURE TONE  
☐ BROADBAND NOISE  
☐ NARROWBAND NOISE  
☐ VARIOUS RANGES

**PARAMETERS**

Frequency Range:  ~  kHz

Bandwidth:  kHz ☐ Octaves

Steps:  ☐ Force steps

Constant Frequency:  kHz

SAM:  ~  Hz ☐ VARY

Duration:  ms

ISI:  ms

Repeats:

☐ RANDOMIZE

GENERATE

CLEAR

PLAY

FOR SAVING:  Filename

Every time you create a stimulus set and broadcast it, a file is automatically saved to MATLAB with the following cells: 1) start times, 2) stimulus ISI, 3) stimulus duration, and 4) stimulus type.

**Stimulus Log**

SAVE LOG

LOG\_XX\_XX\_XXX

Tone of 2 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:53:08.708 AM
Tone of 4 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:53:08.925 AM
Tone of 8 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:53:09.159 AM
Tone of 2 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:53:14.157 AM
Tone of 4 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:53:14.371 AM
Tone of 8 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:53:14.607 AM
Tone of 2 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:53:57.835 AM
Tone of 4 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:53:58.154 A
Tone of 8 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:53:58.370 A
Tone of 1.000000e+01 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:53:58.713 A
Tone of 2 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:53:58.930 AM
Tone of 4 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:53:59.169 A
Tone of 8 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:53:59.386 A
Tone of 1.000000e+01 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:53:59.624 A
Tone of 2 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:53:59.841 AM
Tone of 4 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:54:00.063 A
Tone of 8 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:54:00.287 A
Tone of 1.000000e+01 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:54:00.509 A
Tone of 2 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:54:06.463 AM
Tone of 4 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:54:06.678 A
Tone of 8 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:54:06.913 A
Tone of 1.000000e+01 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:54:07.131 A
Tone of 2 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:54:07.355 AM
Tone of 4 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:54:07.573 A
Tone of 8 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:54:07.798 A
Tone of 1.000000e+01 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:54:08.013 A
Tone of 2 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:54:08.237 AM
Tone of 4 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:54:08.454 A
Tone of 8 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:54:08.677 A
Tone of 1.000000e+01 kHz:	200 ms dur / 0 ms ISI / 0 Hz SAM	July 15, 2016 8:54:08.895 A
CL_ant_100710_22.wav:	[4.473810e+03 ms dur / 3 ms ISI]	July 15, 2016 9:06:35.041 AM
CL_ant_101210_5.wav:	[4.625125e+03 ms dur / 3 ms ISI]	July 15, 2016 9:06:40.186 AM
BO_ant_100710_10.wav:	[3.385624e+03 ms dur / 3 ms ISI]	July 15, 2016 9:06:44.854 AM
BO_ant_100710_11.wav:	[3.217075e+03 ms dur / 3 ms ISI]	July 15, 2016 9:06:48.296 AM

2. Option to save the entire log as a back up. Enter name of the .mat file. It will not be split up the way the automatically saved files are. It's sole purpose is to use as a reference and back up.

1. Enter a filename for saving. Each file created will be noted with a number. To make it easier to find, I suggest making the filename something related to the stimulus set