Recommended resolution setting to run RTAP: 1366x768. Other resolutions may have a different layout.

RTAP (version 1.4.3)

RTAP stands for real-time auditory periphery and it is a Windows-based program that simulates the auditory pathway. It adopts algorithm from Ray Meddis's Matlab Auditory Periphery (MAP) version 1_14. The files are available from the following URL: http://www.essex.ac.uk/psychology/department/HearingLab/modelling.html. Stages from the outer and middle ear (OME) to the auditory nerve spiking probabilities (ANSP) can be selectively simulated. This program can be launched by double clicking RTAP.exe. If unable to run, ensure that Visual C++ redistributable package is installed for either 32-bits or 64-bits Windows. Also ensure that POSIX thread Windows library, pthreadVC2.dll is in the same folder as RTAP.exe.

What's new in version 1.4.3?

There was no way of knowing how long it took to convert a binary file to text file using the conversion feature in RTAP. The conversion progress bar that appeared during conversion also gave no feedback on the quantity of the conversion. So this release arrests such issue by encapsulating the conversion function by the conversion status progress thread class instead of the user interface (UI) class. The thread class is then inherited by the UI class when the latter is invoked.

As part of having a multi-platform OS RTAP available, JUCE based functions have replaced the older conversion algorithm. In future releases, more of such changes will be implemented across the functionality of RTAP. Here are the new features introduced:

- Binary rtap file and folder selection feature implemented for loading.
- Text file and folder selection feature implemented for human readable strings to be dumped.
- Conversion function transferred from UI class to progress status thread class.
- Progress status thread class implemented as an abstract of the UI class.
- Conversion function dependent variables also transferred as private members of the thread class.

RTAP Development & Download

RTAP was developed using Microsoft Visual Studio (VS) 2010 and is exclusively developed for Windows operating system (OS). There are no developments on other OSes. RTAP uses JUCE v3.0.1 as its base development platform. Go to http://www.juce.com to download JUCE v3.0.1. To acquire source code for RTAP, use a SVN tool and download the code from the following address: `svn checkout http://rtap.googlecode.com/svn/trunk/rtap-read-only*`. Once the folders and files are unzipped from JUCE v3.0.1 (and RTAP if they are in a zip file), under the folder /JUCE_master/extras, create a folder called RTAP and copy all the RTAP folders and files into it. The RTAP folder should contain the folders as seen in figure 1. Then launch VS 2010 and open the VS2010 project files from the folder, /JUCE_master/extras/RTAP/Builds/VisualStudio2010/.

*RTAP v1.4.3 onwards is available for download from https://github.com/rtap-dev.

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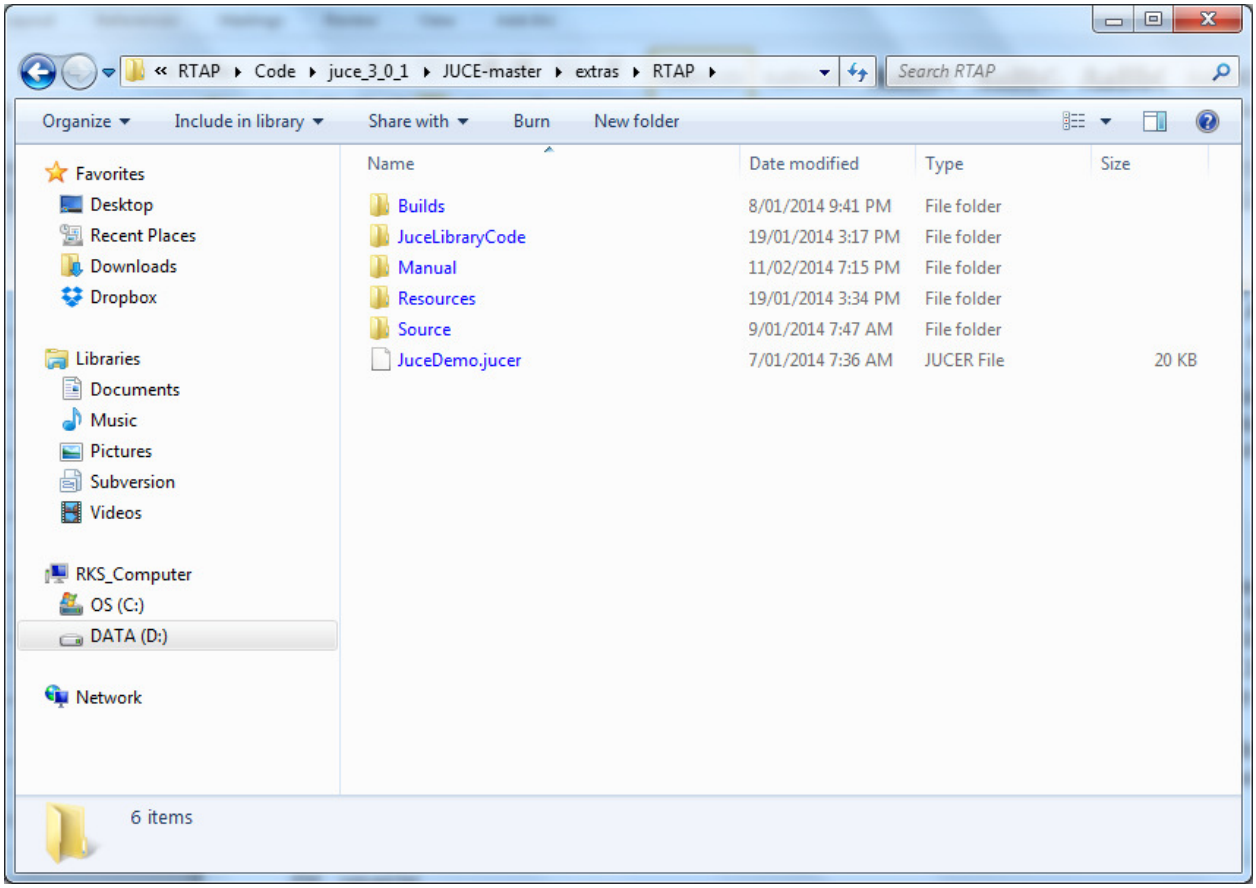

Figure 1: Folders downloaded from SVN in RTAP folder for development.

RTAP has been developed for Windows OS and specifically the Intel processor. This is because RTAP uses Intel Parallel Studio to enhance its computing performance. So if using other CPU besides Intel, then the Intel parallel studio features must be disabled.

Working with RTAP

To launch RTAP, simply double-click RTAP.exe available in the folder: /JUCE_master/extras/RTAP/Builds/VisualStudio2010/. However before doing so, ensure that pthreadVC2.dll is present in the same folder as RTAP.exe. This dynamic link file provides POSIX thread support which RTAP requires for its parallel computing. Launching RTAP invokes an introduction screen as displayed in figure 2.

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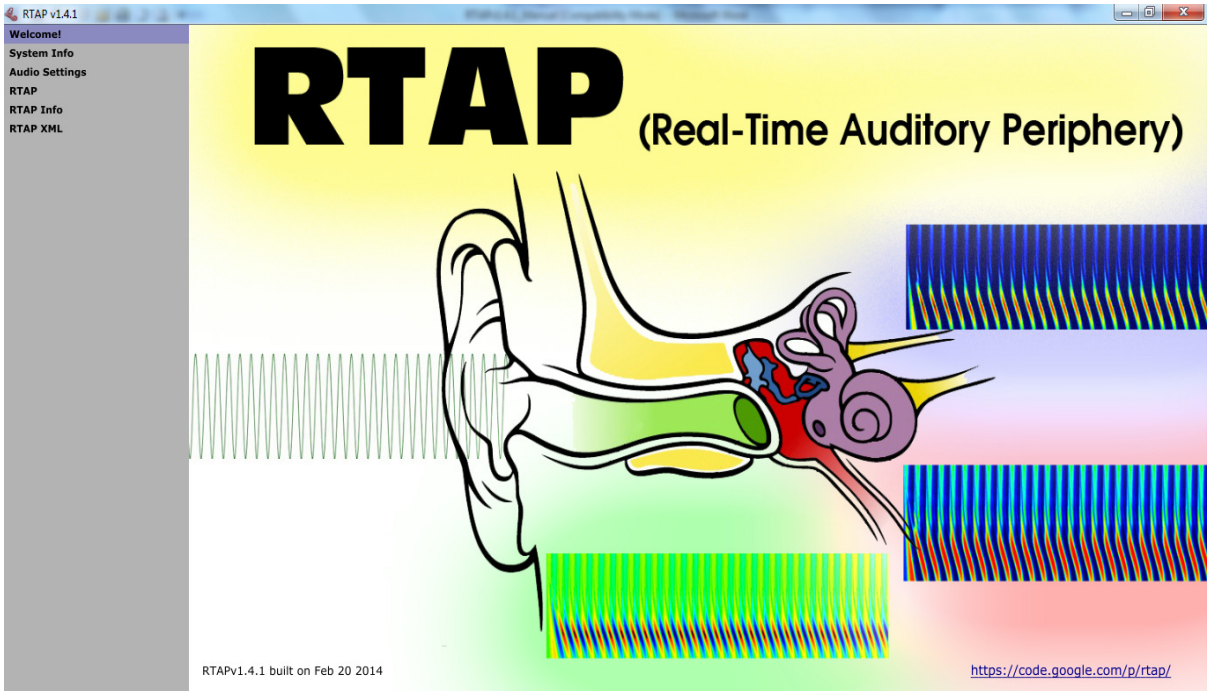

Figure 2: RTAP introduction screen

Click on 'Audio Settings' on the options available at the top left hand corner of the user interface (UI). This brings up the audio setup page as seen in figure 3. Click on the 'Windows Audio' combo box and select 'DirectSound' labelled as (a) in figure below. Then under the 'Primary Sound Capture Driver' combo box (b), select either 'Stereo Mix' or 'Microphone'. Either of these two options must be selected to inject a sine tone into RTAP. 'Stereo Mix' option re-routes audio from the computer to RTAP instead of the speakers (audio loopback). 'Microphone' option routes audio from the microphone channel to RTAP (Note: If there is no built-in microphone, then an external microphone is required to be connected to the computer).

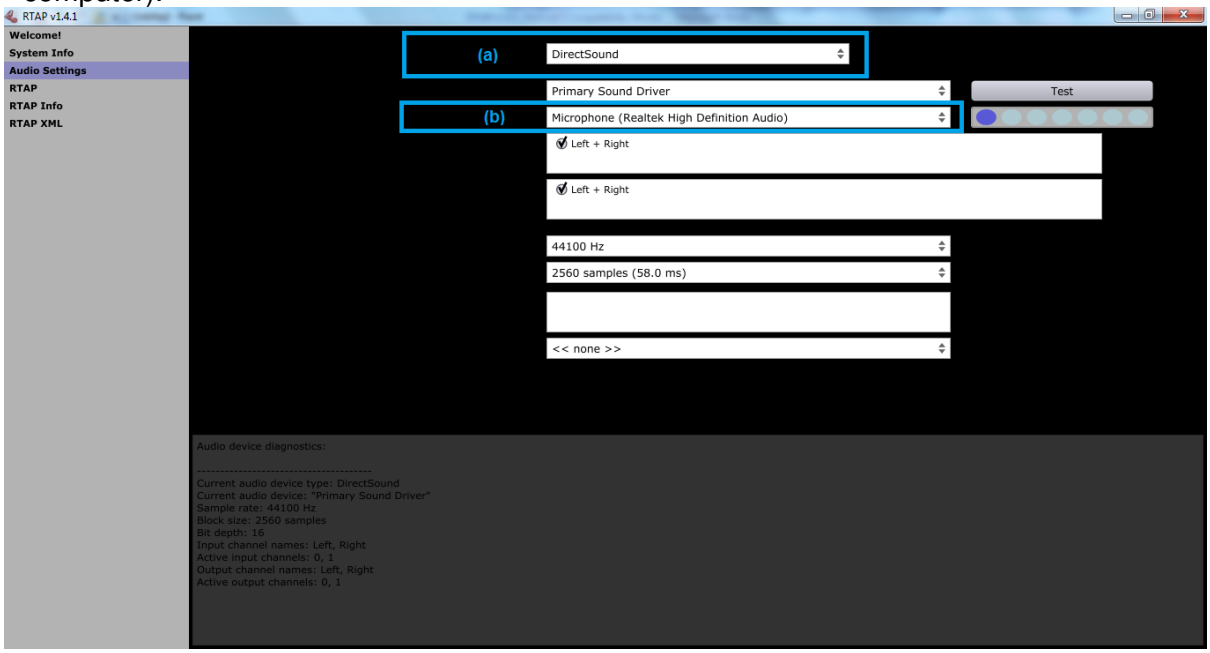

Figure 3: Audio setup page

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Once the respective audio setup options are selected, click on the 'RTAP' option at the top left hand corner of the window to display the main UI for RTAP. Before clicking the 'Play' button, adjust the necessary parameters described in the next paragraph as well as in the next two tabs (available above black screen) if necessary. Then click on the 'Set' button to configure RTAP followed by 'Play' to initiate the real-time audio processing and audio image display.

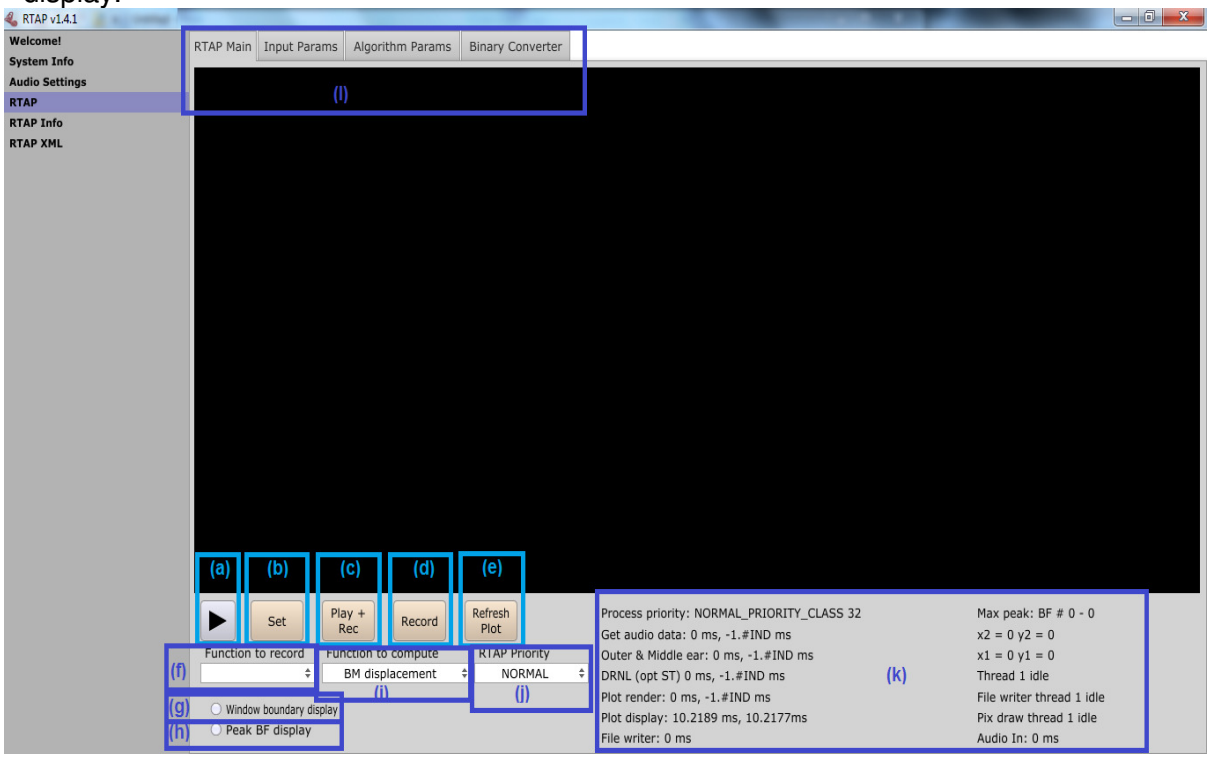

Figure 4: RTAP main UI tab

The features for RTAP main UI tab page based on figure 4 are as follow:

a) Play/Pause (triangle icon) button starts and pauses the algorithm processing in RTAP.
b) Set button assigns user defined memory space for coefficients and constants for the equations used in the auditory pathway (AP) model. Once parameters are set this should be the first control button to be clicked before either (a) Play or (b) Play+Record button is clicked.
c) Play+Record button initialises the start of the algorithm processing as well as the recording of the data output from the first two window frames. This is useful for recording the first two window frames of response signal generated by the simulator.
d) Record button starts the recording of two window frames of data output from a stage within the AP model. Unlike the Play+Record button, this button starts recording only after the Play button is clicked to initiate the algorithm processing.
e) Refresh Plot refreshes the static image representation of the response data in either scatter, line or spectrogram plot format.
f) Selects the response data of a stage in the auditory pathway to record.
g) Draws vertical lines on the waveform plot to visually differentiate windowed data processing stages.
h) Displays BF channel plot with the peak amplitude.
i) Selects the stage in the auditory pathway model to run.
j) Selects the priority at which RTAP runs. The higher the priority the more attention RTAP gets from the central processing unit (CPU) making it run quicker than it did at a preceding

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priority i.e. Running at ‘’Above Normal’ priority has a quicker response time than ‘Normal’, ‘High’ quicker than ‘Above Normal’ and ‘Real-time’ processing has the quickest response time.

k) Displays processing times and thread processing feedback.

l) Tabs for adjusting audio input stream, algorithm parameters and offline RTAP binary conversion.

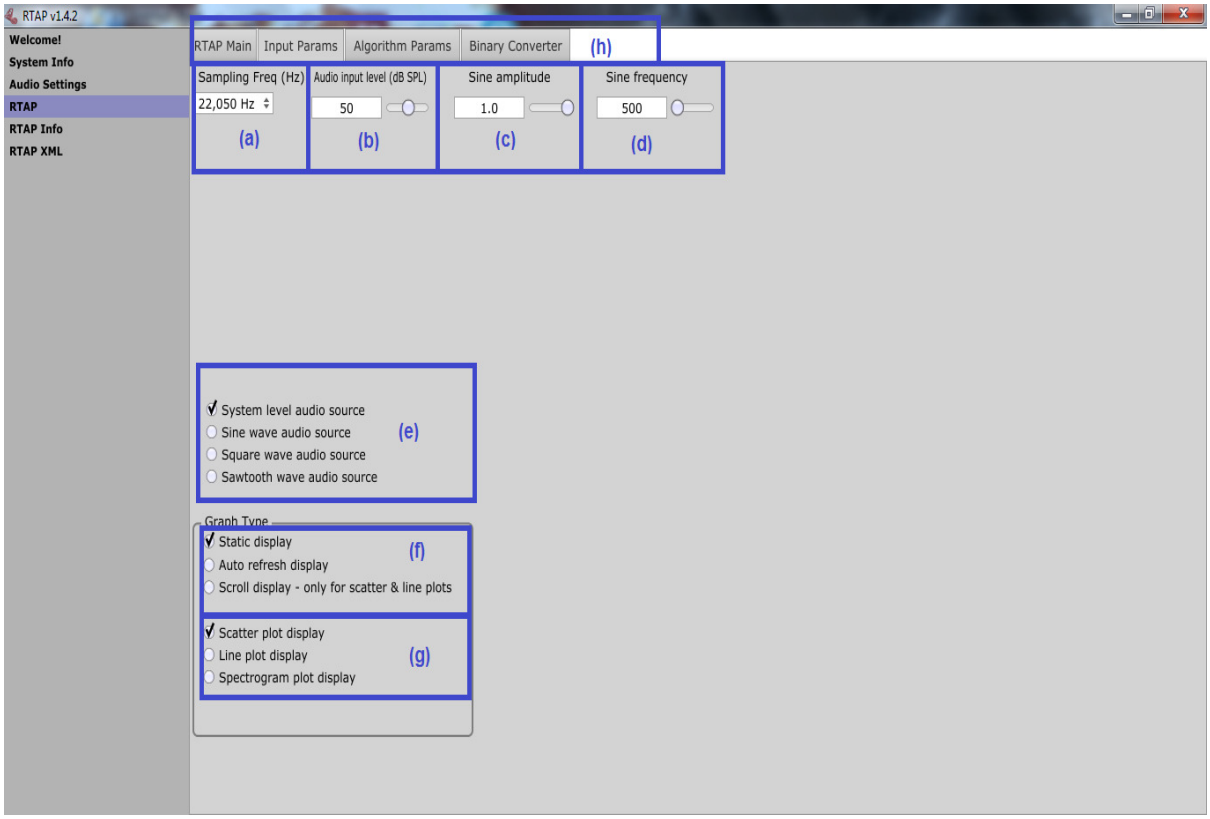

Figure 5: RTAP audio UI tab

The features for RTAP audio UI tab page are as follow:

a) Selects the sampling frequency.

b) Selects the input stimulus level in dB SPL.

c) Scales the sine tone amplitude.

d) Selects the frequency of the sine tone.

e) Selects either the system audio stream input (audio loopback or microphone), sine tone input, square pulse input or saw tooth input.

f) Selects either static, auto refresh or scroll waveform plot display.

g) Selects either scatter, line or spectrogram waveform plot.

h) Selects other tab for RTAP configuration.

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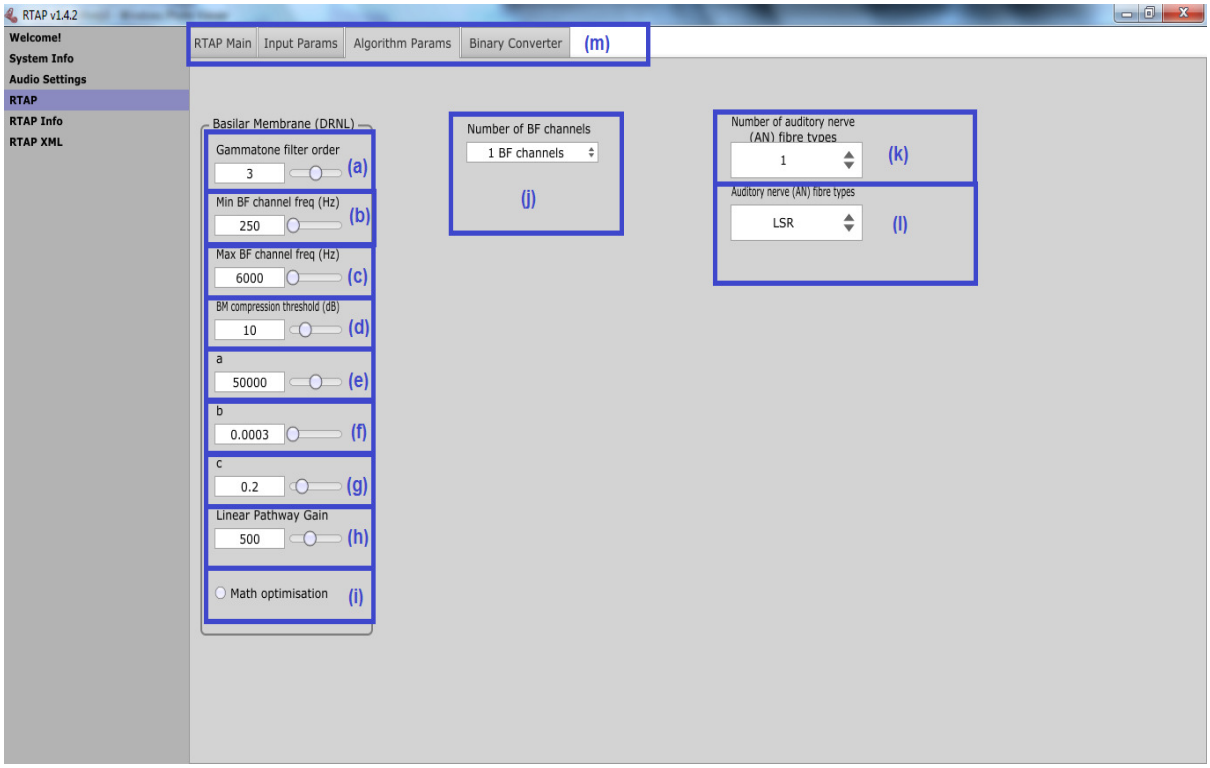

Figure 6: RTAP algorithm UI tab

The features for RTAP algorithm UI tab page are as follow:

a) Varies gammatone filter order in the range of 1 to 5 (affects both linear and nonlinear bandpass filterbanks order).
b) Selects the minimum BF in the frequency range for analysis.
c) Selects the maximum BF in the frequency range for analysis.
d) Compression threshold that defines the nonlinearity in the dual resonance nonlinear filter (DRNL) that simulates the basilar membrane (BM) displacement.
e) Scales the amplitude in the linear pathway of the DRNL filter.
f) Currently unused.
g) Scales the compression in the nonlinear branch of the DRNL filter.
h) Linear pathway gain.
i) Math optimisation to accelerate RTAP processing.
j) Either click or type in the number of best frequency (BF) channels.
k) Number of auditory nerve (AN) fibre types i.e. 2 selects low spontaneous rate (LSR) and high spontaneous rate (HSR) AN fibres; 1 selects only the LSR AN fibre.
l) Selects either low (LSR) or high spontaneous rate (HSR) fibre output processing for either neurotransmitter rate or auditory nerve (AN) firing probability.
m) Selects other tab for RTAP configuration.

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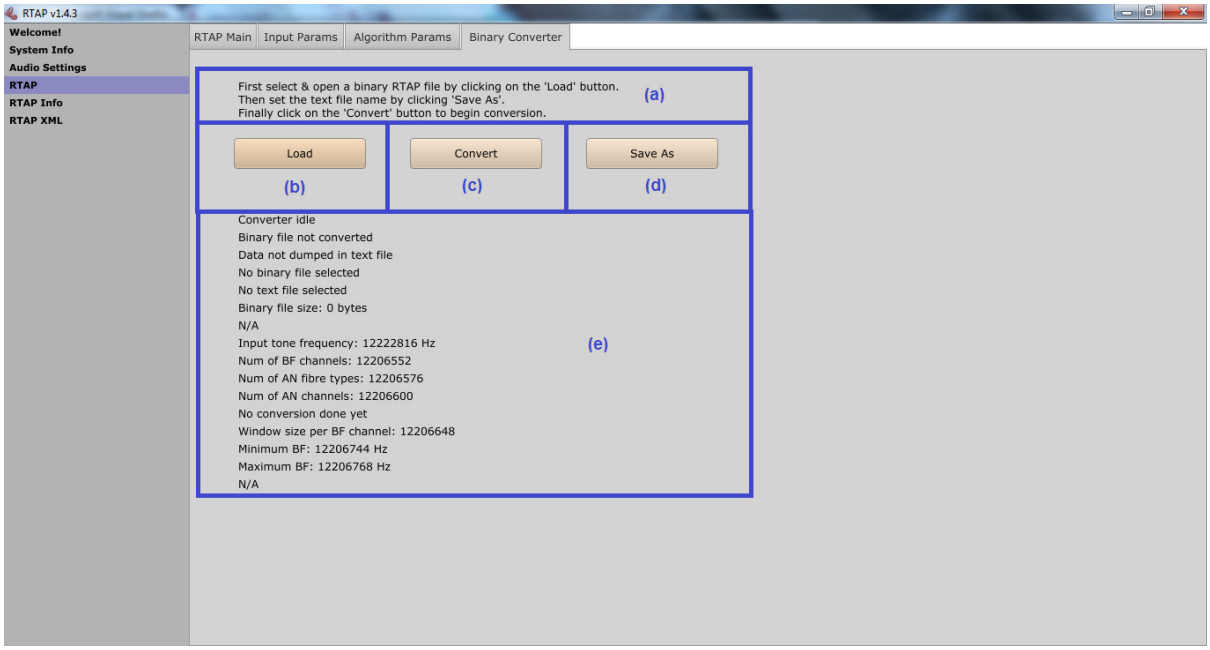

Figure 7: RTAP offline binary converter UI tab

The features for RTAP offline binary conversion UI tab page are as follow:

a) Instructions to use the binary converter.
b) Select a binary RTAP file from any folder.
c) Converts the contents of the binary RTAP file to human-readable string in a text file. (Note: This button only works after a binary RTAP file is selected and the text file is specified by clicking 'Load' & 'Save As' buttons respectively.
d) Creates a new text file for the converted contents of the selected binary RTAP file to be dumped into.
e) Conversion feedback information.

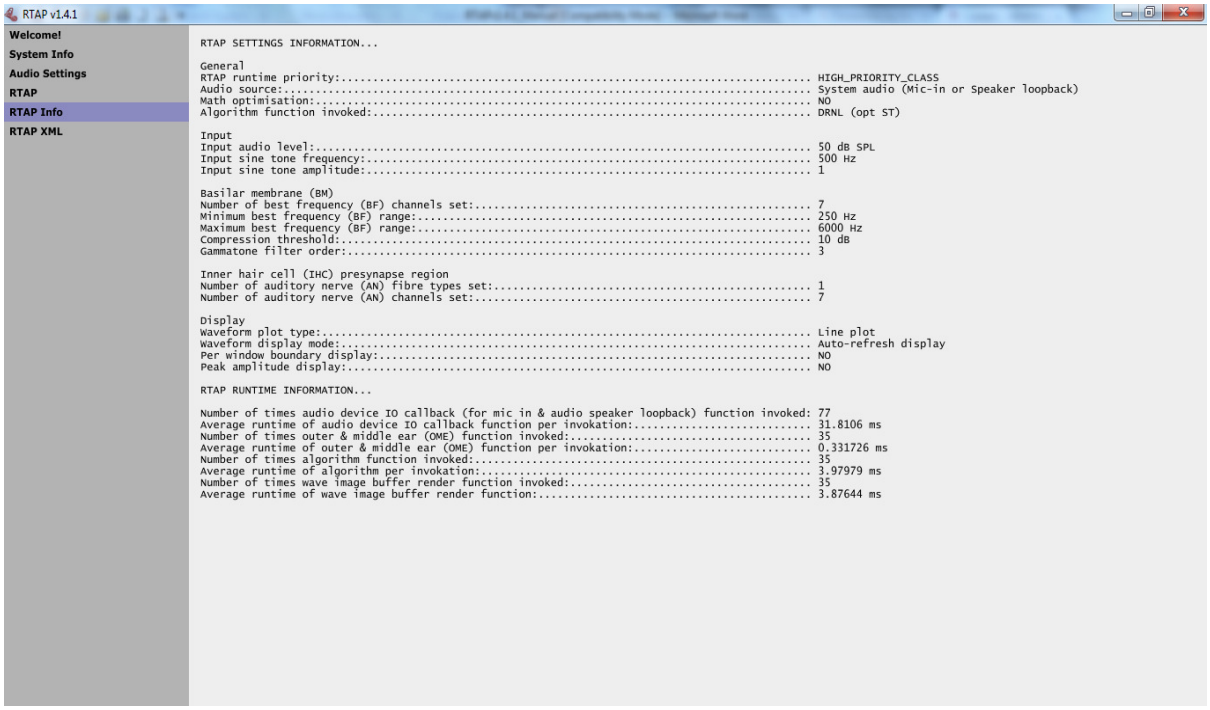

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Figure 8: RTAP info page

This page can be selected from the 'RTAP Info' option listed at the top left hand corner. This page provides computing information parameters based on the runtime of RTAP.

Figure 9: RTAP XML code editor

To use the XML code editor, use the UI to set the parameters accordingly. Then click on the 'Set' button in the main RTAP UI page (the one with the big black screen). Once this is done the RTAP is configured with the new parameters. You can view settings in RTAP Info page or you can generate them as XML settings available from the 'RTAP XML' option at the top left hand corner of the screen and as seen in figure 9. The following buttons can be used at the RTAP XML page.

a) Click on the 'Generate' button to acquire the RTAP parameters configured and display them on the screen as XML parameters. Here XML scripts can be modified with parameters based on the comments supplied in the script. Once completed, return to the 'RTAP' main page with the black screen (figure 4) and click on 'Set' before clicking on 'Play'. The audio settings from figure 3 must be set before the 'Set' and 'Play' buttons are respectively clicked.
b) Click on the 'Load' button to load an XML script from a preferred location on the computer.
c) Click on the 'Save' button to save the XML script to a preferred location on the computer.

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