User Guide for Yet another Aurio analyseR

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1 Disclaimer

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2 Introduction

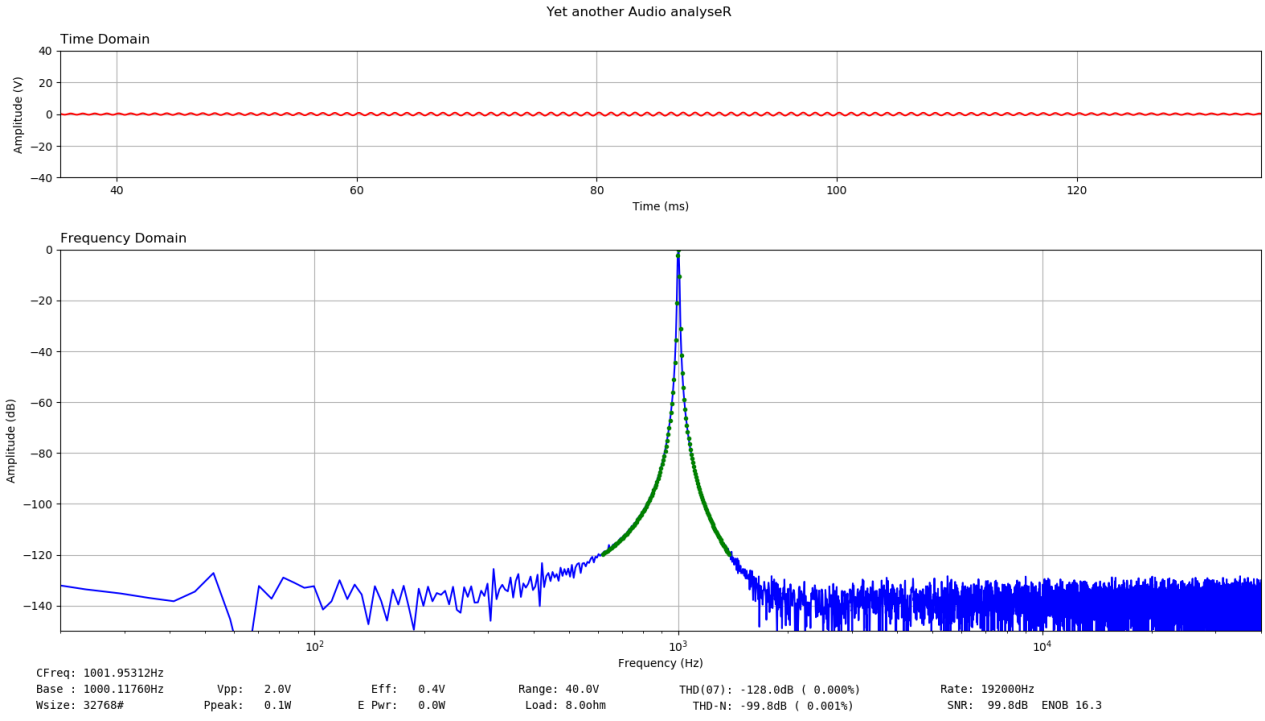
The yet another audio analyzer (yar) to do different measurements based on FFT using the sound layer. The software was tested by the E1DA ADC device (see https://e1dashz.wixsite.com/index/cosmos-adc), which has an 32 bits ADS and sampling up to 768kHz.

3 Test Run

To perform a simulated test with a 1kHz signal, with 100dB

```
./yar2.py --simfreq 1000 --simnoise 100 --plot sim --duration 10
```

The software will run approx 10 seconds and will create a sim_1000Hz.png file, what also will be displayed:



4 Explanation of the measurements

4.1 CFreq

Center frequency of the greatest FFT component. The correct THDN results may be reached if the signal generator provides frequencies exactly the same as the provided center frequencies. In case of no match, the system may two (lower and higher) best match.

4.2 Base

Base or fundamental frequency computed by from the FFT.

4.3 Wsize

FFT window size

4.4 Vpp

Peak-to-peak voltage

4.5 Ppeak

Peak power

4.6 Eff

Effective or RMS voltage

4.7 E-Pwr

Effective power or RMS power

4.8 Range

Selected range

4.9 Load

Selected load (to compute power)

4.10 THD(07)

Computed THD value using 7 harmonics.

4.11 THD-N

Computed THD-N value

4.12 Rate

Sampling rate

4.13 SNR

Computed signal to noise ratio

4.14 ENOB

Effective number of bits

5 Command line switches

5.1 -h, –help

To print help screen

5.2 –list

To print the list of audio devices. The program exits after all devices are listed.
Example:

```
./yar2.py --list
Input Device id  0  -  HDA Intel PCH: ALC298 Analog (hw:0,0)
Input Device id  6  -  E1DA Cosmos ADC PCM32/768: USB Audio (hw:1,0)
Input Device id  7  -  sysdefault
Input Device id  13  -  lavrate
Input Device id  14  -  samplerate
Input Device id  15  -  speexrate
Input Device id  16  -  pulse
Input Device id  17  -  upmix
Input Device id  18  -  vdownmix
Input Device id  20  -  default
```

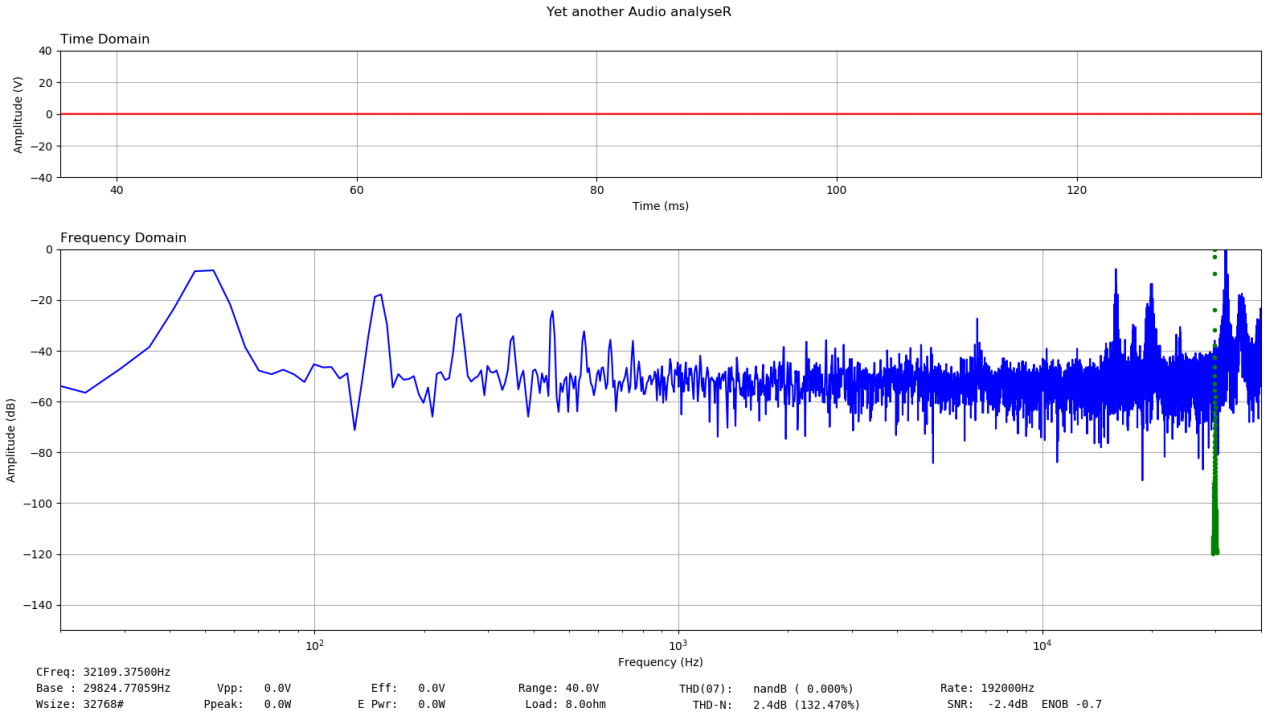
5.3 –freq NUMBER

The hardware sample rate, default is 192000Hz.

5.4 –dev NUMBER

Device to be used. The –list command displays the possible ids, default is 4.
Example:

```
./yar2 --dev 6
```



5.5 –chsel NUMBER

The selected channel (e.g. 0 for left side, 1 for right), default is 1.

5.6 –chnum NUMBER

The number of channels (e.g 1 for mono, 2 for stereo), default is 2.

5.7 –chunk NUMBER

The FFT window size, default is 32768. The system always takes the closest 2 power, so the 1000 will result 1024 automatically.

5.8 –skip NUMBER

Skip an amount of samples before doing FFT. Some audio devices has some bad behavior with the first some samples after opening it. Default is 1024.

5.9 –adcrgn NUMBER

The range of ADC chip, when is shows 0xff*. Default is 100V

5.10 –adcres NUMBER

The adc resolution, default is 32 (bits).

5.11 –vrange NUMBER

The voltage range in the time domain displaying in V, default is 40V.

5.12 –frange NUMBER

The frequency range in the frequency domain displaying in Hz, default is 40kHz.

5.13 –trange NUMBER

The time range in the time domain displaying in ms, default is 100ms. The system automatically displays the mid.

5.14 –wrange NUMBER

The FFT range in the frequency domain displaying in dB, default is -150.

5.15 –rload NUMBER

The size of the load resistor in ohm, to compute the power measurements from the voltage, default is 8ohm.

5.16 –thd NUMBER

Number of harmonics for THD calculation, default is 7. The THD(..) on the display changes accordingly to this settings.

5.17 –duration NUMBER

The software can be closed any time by the user, but after this time the system will exit. This is for help to run from scripts.

5.18 –plot FILE

The system automatically plots to file in case of stable fundamental frequency for 3sec (10sec in AVG mode).

For example if the –plot TEST was invoked and the signal generator provides 1kHz signal after 3sec (10sec in AVG mode) a file will be written TEST_1000Hz.png. If the signal generator changes to 400Hz and it is stable for 3sec (10sec in AVG mode) a new file will be written with the name TEST_400Hz.png.

5.19 –csv FILE

The measurements are written into csv file. In case of stable fundamental frequency for 3sec (10sec in AVG mode). The program generates csv header if the file was not existing and appending the measurement to the generated or existing file.

5.20 –window [bartlet—blackman—hamming—hanning—none]

Select FFT window, default is hanning.

5.21 –avg

Doing FFT averaging. In case of change of fundamental frequency, the averaging starts from the beginning.

5.22 –simfreq NUMBER

For testing purposes only, feeding the software locally by fixed frequency.

5.23 –simnoise NUMBER

For testing purposes only, feeding the software locally by SNR dB. Use together with –simfreq options.

5.24 –flttsh NUMBER

Threshold in dB to determine filter for the spectral leakage at around the fundamental frequency. The system feeds an ideal sinus at fundamental frequency and the selected threshold determines a width or mask. This is displayed by the green dots on the frequency domain screen.

5.25 –fnttsh NUMBER

The fundamental voltage may computed by number of components, default is 3dB.

5.26 –frqtsh NUMBER

To compute the fundamental frequency, the selected in dB strongest components are used.

5.27 –cftsh NUMBER

For determine the spectral leakage, the system may use fundamental frequency or center frequency of the strongest FFT components.

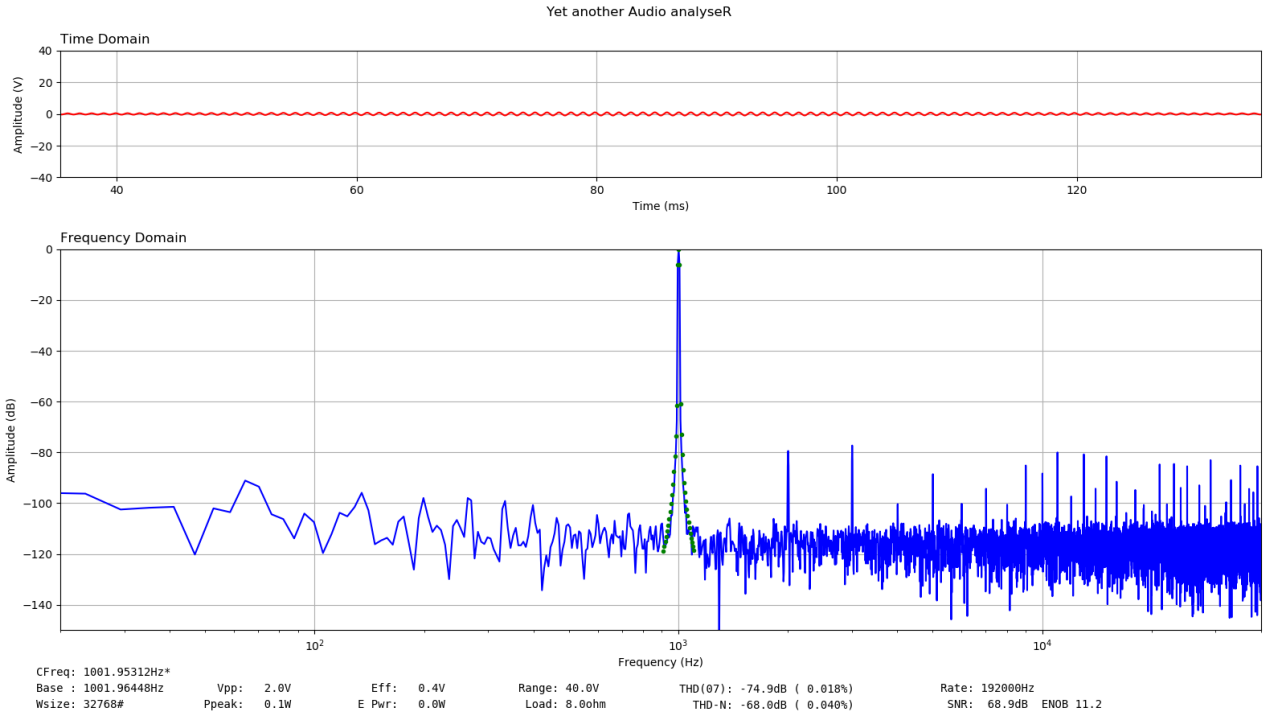
6 Example Use

6.1 Apply random frequency

6.2 Simple Measurement

An UNI-T UTG932E Function generator is connected the E1DA Cosmo ADC right cannel. The generator provides 1001.953Hz sinus signal:

```
./yar2 --dev 6
```

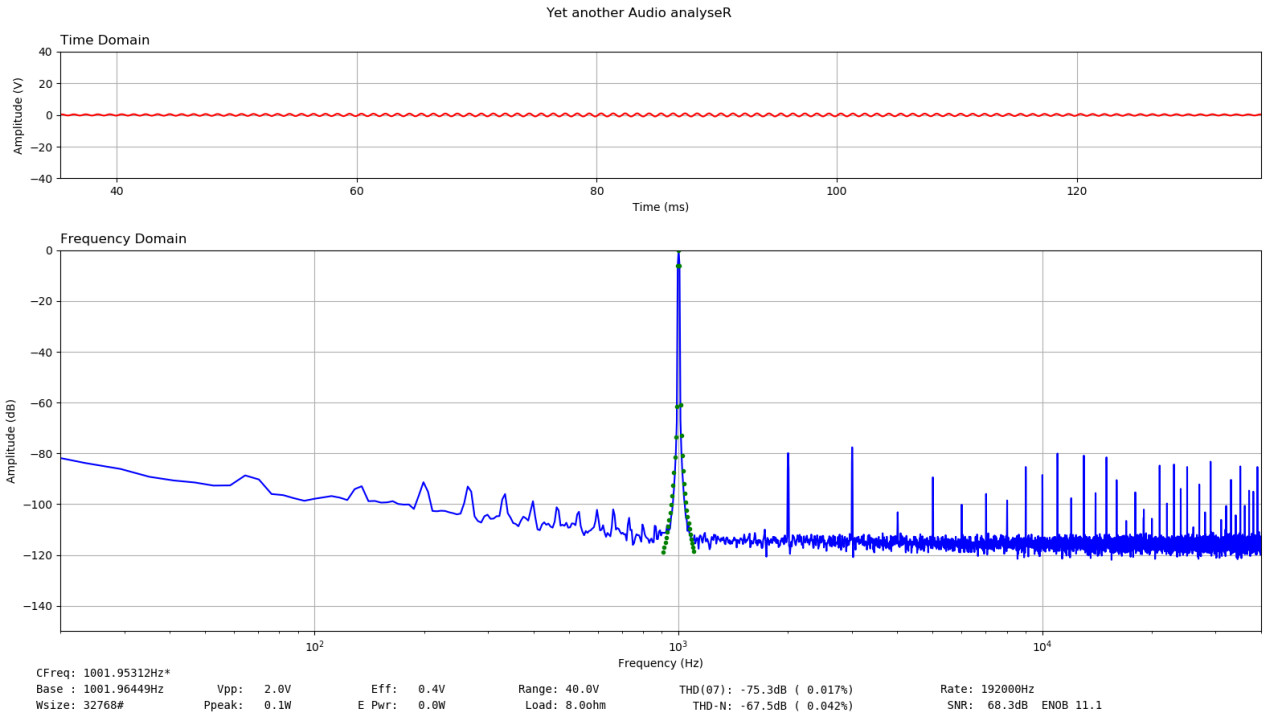


The green dots are showing the spectral leakage and the values under the green curve is not used for noise SNR and THD-N calculation. The '*' behind the CFreq means that the cenrer freq was used for the ideal sinus instead of the base frequency.

6.3 FFT average

An UNI-T UTG932E Function generator is connected the E1DA Cosmo ADC right cannel. The generator provides 1001.953Hz sinus signal:

```
./yar2 --dev 6 --avg
```



The green dots are showing the spectral leakage and the values under the green curve is not used for noise SNR and THD-N calculation. The '*' behind the CFreq means that the cenrer freq was used for the ideal sinus instead of the base frequency.

6.4 CSV output

An UNI-T UTG932E Function generator is connected the E1DA Cosmo ADC right cannel. The generator provides 404.29688Hz sinus signal.

```
./yar2 --dev 6 --csv ugt932e.csv
```

After 10 secs the frequency changed to 1001.953Hz.

```
gbiro@t470s-spring:~/yar$ cat utg932e.csv
Carrier,THD,THD DB,THD-N,THD-N DB,SNR,ENOB,Vrms,Prms
404.301377,-75.515300,0.016758,-67.449184,0.042417,68.186247,11.034260,0.425204,0.022600
1001.964257,-75.330104,0.017120,-68.066836,0.039506,68.970155,11.164478,0.424833,0.022560
```