HP / Agilent 8903B Audio Analyzer software
Installation and User manual

Intro

The Audio Analyzer software is intended to be used with the HP / Agilent (now Keysight) 8903B Audio Analyzer connected to a USB port of a PC via the low cost open source AR488 or compatible GPIB(HPIB)/USB interface to automate measurements on audio equipment.

It is assumed you are familiar with the analyzer and know how to connect devices under test (further referred to as DUT).

The GPIB interface uses an old and slow protocol so there are some delays built in to the software to allow the analyzer to do his thing, after all most of these analyzers are made in the 1980's. Be patient…

About me

I'm retired with many years of experience in repair of consumer and high-end electronics, process/product/software/test equipment engineering, engineering/quality/regulatory/operations management.

As one of my hobbies I build tube amplifiers for which I use the 8903B, I wrote this program for my personal use but because it can benefit other users I made it available as freeware.

Contact: jef.collin@gmail.com

License Agreement

The software is developed in LabVIEW (community edition) and works with the LabVIEW runtime. LabVIEW © National Instruments.

The software is provided as freeware, you can use, copy or distribute the software. The software cannot be sold or used for commercial or industrial purposes due to the license agreement of LabVIEW community edition. It does not contain spyware, malware, adware…

Hardware setup

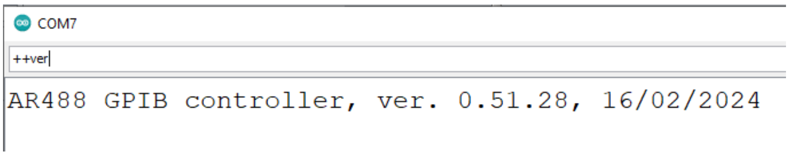
Besides the 8903B Audio Analyzer you need a GPIB to USB interface, the software is designed for the low cost open source AR488. Compatible interfaces might work but are not tested (Prologix, Galvant). The “Centronics” connector of the interface plugs into the GPIB port of the analyzer and the USB cable in the PC. Power is provided via the USB port.

Details on how to build the AR488: https://github.com/Twilight-Logic/AR488

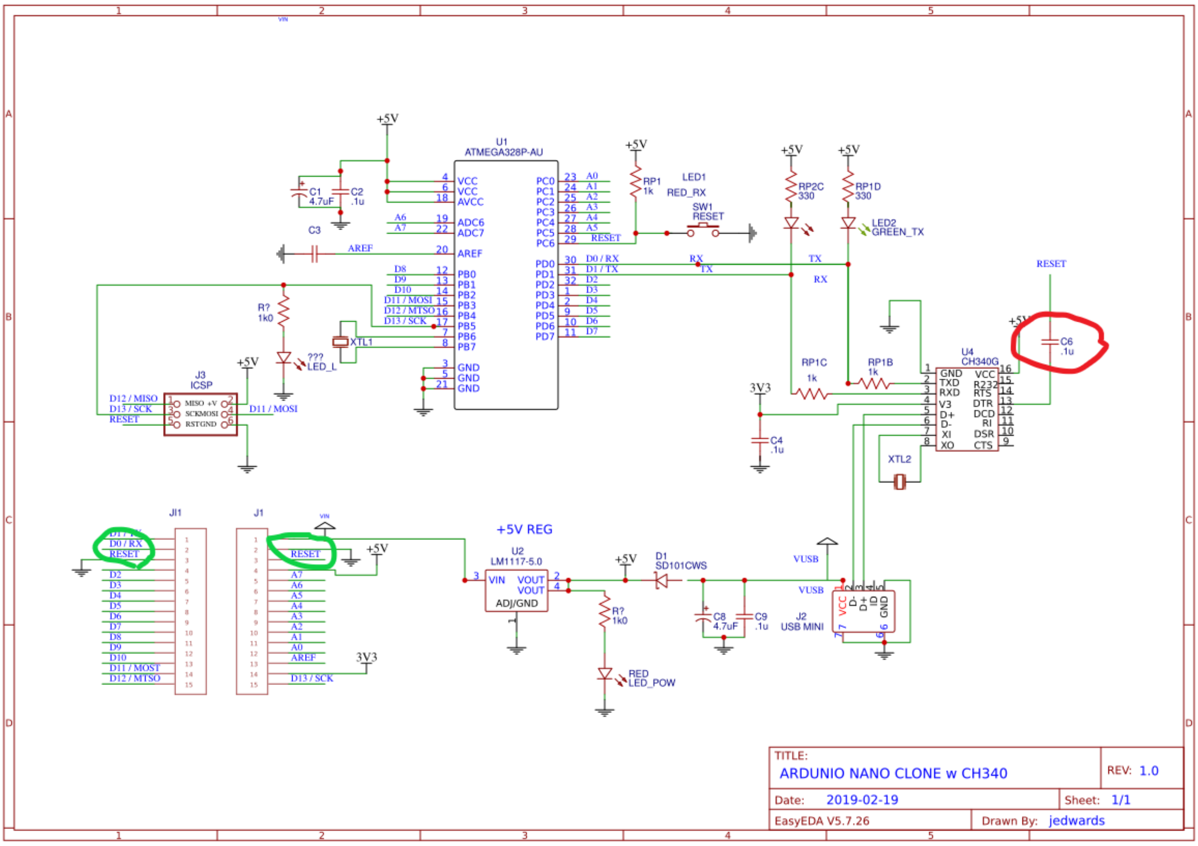
Basically you need an Arduino Nano (or one of the other Arduino boards) and a 24 pin male “Centronics” connector. I made a bracket to hold the connector and a piece of prototype board, the Nano is inserted into two rows of socket connectors and header pins are used to connect to the connector.

Wiring diagram and the sketch for the Arduino can be found on the above website, you need the Arduino IDE to download the software into the Nano, I recommend using IDE version 1.8.19 in portable mode. Besides the IDE you might need to install additional serial port drivers depending on the serial interface IC used in your Arduino board, you will notice this when the board is not detected by the IDE.

Once completed you can test the AR488 by connecting it to the USB port only and using the serial monitor feature in the Arduino IDE, set the baud rate to 115200, type the command ++ver, the AR488 should respond with its software signature.



Important: once the AR488 build is completed there is one further step to consider. Every time a connection is made over the serial port some boards like the Nano will reset itself to allow the bootloader to detect if new software has to be downloaded. This reset cycle takes several seconds and occurs every time a measurement is started, to avoid this delay the Nano board can be modified by removing the capacitor (encircled in red) between the DTR output of the serial interface IC and the RESET input of the CPU, identify the correct capacitor by measuring with an ohm meter between one of the RESET pins of the Nano board connectors (encircled in green) and one side of the capacitor, the capacitor is most likely located on the bottom side of the board. Note: after this modification you need to press the reset button when uploading a new sketch to the Nano.



The software has a setting to use a (3 second) delay at each connection (for an unmodified Nano) or not (for a modified Nano or any other board that does not reset upon connection).

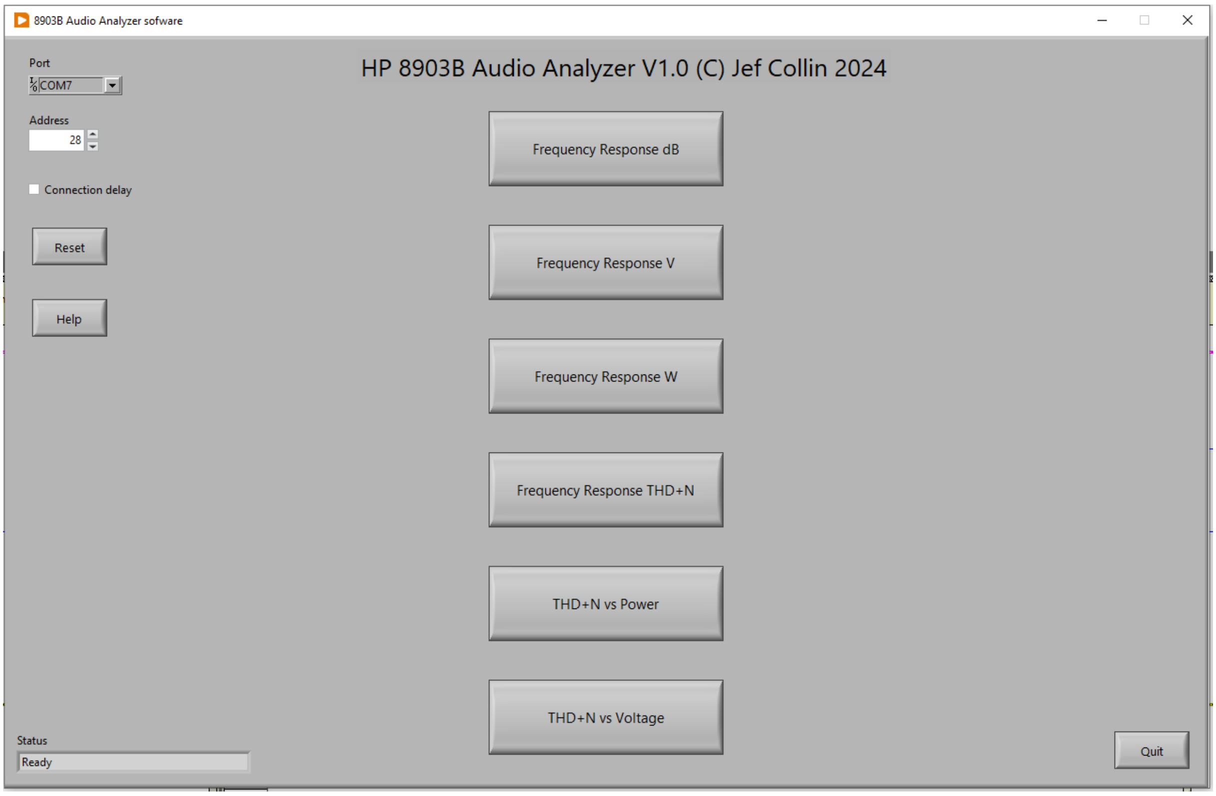
Software setup

The system requirements are a PC with Windows 7 (service pack 1) or newer, screen resolution minimum 1280x800, 1GB ram and 1GB disc space.

To install the software download the ZIP file, unpack somewhere and click install.exe. Follow the instructions on the screen.

Using the software

Main screen



Port

The GPIB/USB interface will show up as a virtual serial or COM port. Select the port matching the interface or click *refresh* to scan for new equipment.

Address

Set it to the GPIB address of the 8903B, the default is 28 which is the address for the analyzer as set in the factory, you can change the address inside the analyzer, refer to the guides of the analyzer.

Connection delay

Check this box if you use a non-modified Arduino Nano or uncheck if the interface does not reset when a connection is made. Refer to the hardware setup section. This setting activates or deactivates a 3 second delay between connecting and initializing the interface.

Reset

Click this button to verify if the interface is connected, the correct COM port is selected and the analyzer can be addressed. It will connect, initialize and send a clear device message to the analyzer, you should see activity on the front panel of the analyzer and a “relay clicking” sound. If no errors occur you can start measuring. The analyzer is now reset to its power on defaults.

Help

Open this manual.

Status

Shows status and activity messages so you know what is going on.

Frequency Response dB

Click to go to the Frequency Response measuring screen, output level in dB is plotted versus frequency.

Frequency Response V

Click to go to the Frequency Response measuring screen, output voltage is plotted versus frequency.

Frequency Response W

Click to go to the Frequency Response measuring screen, output power is plotted versus frequency.

Frequency Response THD+N

Click to go to the Frequency Response measuring screen, distortion percentage is plotted versus frequency.

THD+N vs Power

Click to go to the distortion measuring screen, distortion percentage is plotted versus output power.

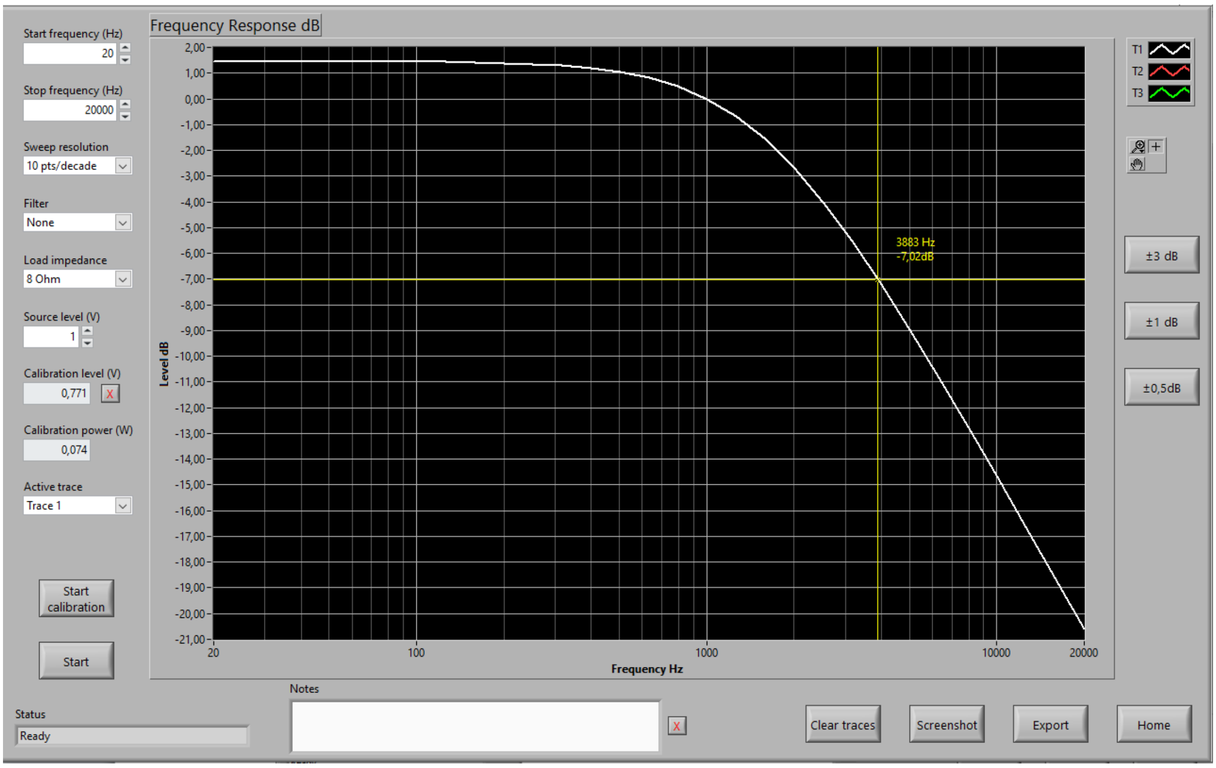
THD+N vs Voltage

Click to go to the distortion measuring screen, distortion percentage is plotted versus output voltage.

Quit

Quit the software.

Frequency Response dB



Start frequency

Set the begin frequency of the frequency sweep.

Stop frequency

Set the end frequency of the frequency sweep.

Sweep resolution

Select the number of measurement points per decade. More points means a higher resolution of measurement but increases test time.

The frequency sweep feature of the analyzer is not used, the logarithmic sweep pattern is replicated based on the algorithm in the user guide of the analyzer, the 255 total points limit of the analyzer's sweep function does not apply.

Filter

Select one of the available filters, selection is limited to the two standard low pass filters, the other two filters are option based and not relevant for audio equipment.

Load impedance

Select the load impedance on the DUT output, this value is used to calculate power output.

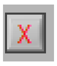
Source level

Set the output level of the generator, because the intended use is audio equipment the range is limited to 2V rms to avoid clipping of the output of the DUT. Set to a low initial level and follow the calibration procedure to set at the level that achieves the desired output level of the DUT. The frequency sweep is done with this fixed source level.

Warning: setting this level too high can cause clipping of the output signal of the DUT and may cause damage to it, set this level carefully. The generator output is only turned on during the calibration or test cycle.

Calibration level

Displays the measured output level from the calibration cycle, refer to *Start calibration*.



Click the *delete* button to clear the calibration level, it must be 0 to make absolute measurements versus relative measurements, refer to *Start*.

Calibration power

Displays the calculated output power of the DUT based on calibration level and load impedance setting. This makes it easier to calibrate the source level to achieve the desired DUT output power at which you want to take the measurements.

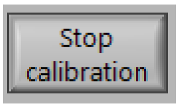
Active trace

Select one of the three available traces for the next measurement, any previous measurements for the same trace will be overwritten.

Start calibration

To display measurement results relative to a reference level (0 dB) the output of the generator of the analyzer needs to be calibrated to achieve the desired output level of the DUT at which you want to take the measurements, for example for an output level corresponding to 1W of power into an 8 Ohm load you calibrate the output level to 0.355 V. For absolute measurements instead of relative measurements you can skip the calibration cycle but the reference level must be set to 0.

Click to start the calibration cycle, the generator will be turned on at a frequency of 1KHz and the set source level. Adjust the source level until the desired calibration level (voltage or power). Allow the analyzer to settle, it needs some time to adjust to changes in settings.

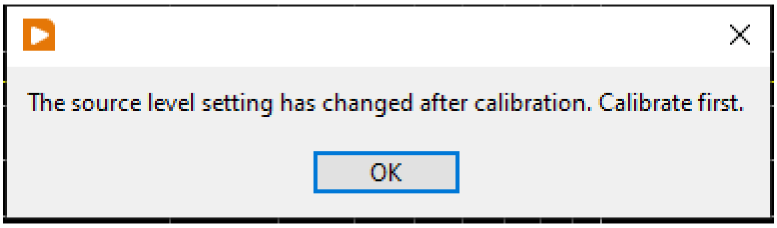


Click *Stop calibration* to end the calibration cycle, the displayed calibration level will be used as 0dB reference level for the next measurements. Make sure to recalibrate if changes are made to the setup.

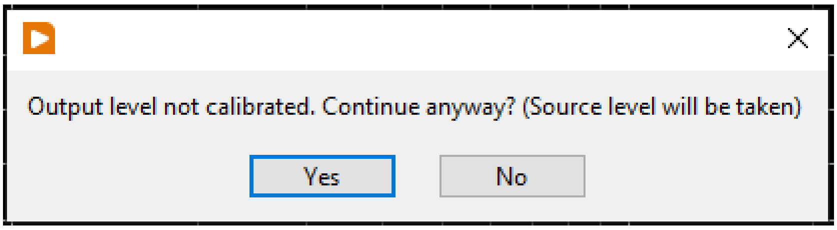
Start

Click to start the measurement cycle.

If the source level setting changed after calibration a warning message will be displayed and the measurement will abort. Not applicable if the calibration level is set to 0.

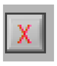


If the calibration level is 0 a warning message will be displayed and the you have an option to continue using the source level as reference or cancel. Click *Yes* to enable absolute measurements.



Notes

Enter notes about the measurement, these will appear on the screenshot and the CSV export to identify for example the DUT you measured and conditions.



Click the *delete* button to clear the notes.

Clear traces

Click to clear all three traces.

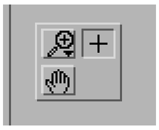
Screenshot

Click to take a screenshot. A save dialog appears, the date/time stamp is used in the proposed filename.

Export

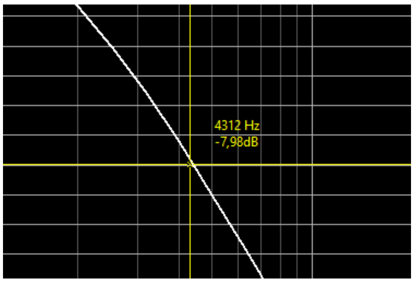
Click to export the measurement to a CSV file which can be opened by Excel or other compatible spreadsheet software. A save dialog appears, the date/time stamp is used in the proposed filename. The three traces are listed individually, the header contains the notes.

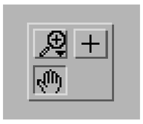
Graph palette



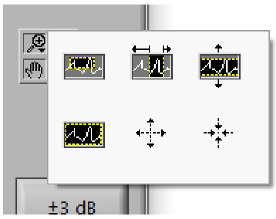
Click the + icon to move the yellow cursor.

Click and drag the yellow cursor to move it, you can move the horizontal line, vertical line or crosshair. When a measurement is completed, once you move the cursor the coordinates will appear. Click and drag the coordinates to move it to another location relative to the cursor.





Click the *hand* icon to drag the view across the window.



Click the *magnifier* icon to open the zoom options:

- Zoom window, click and drag to zoom that area.
- Zoom horizontal.
- Zoom vertical.
- Zoom maximum.
- Zoom out, click and drag.
- Zoom in, click and drag.

±3 dB

Set the vertical scale to ±3 dB.

±1dB

Set the vertical scale to ±1 dB.

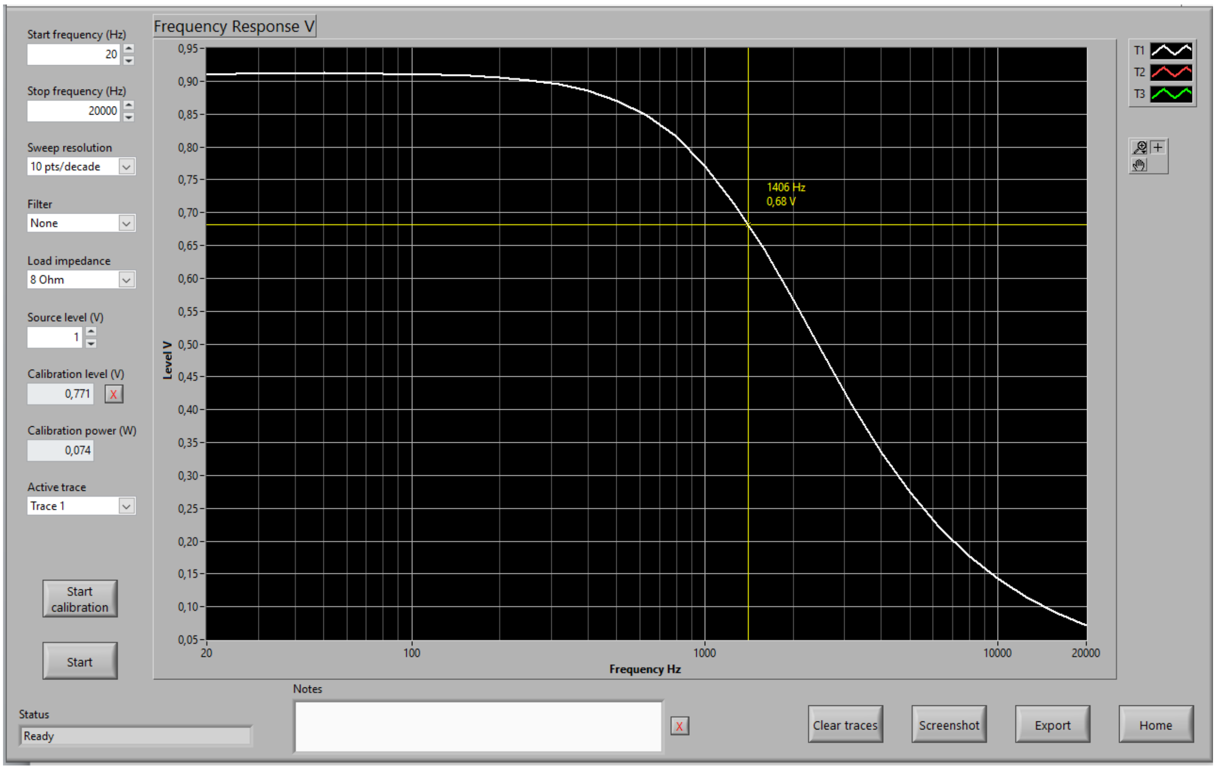
±0.5dB

Set the vertical scale to ±0.5 dB.

Home

Return to the main screen.

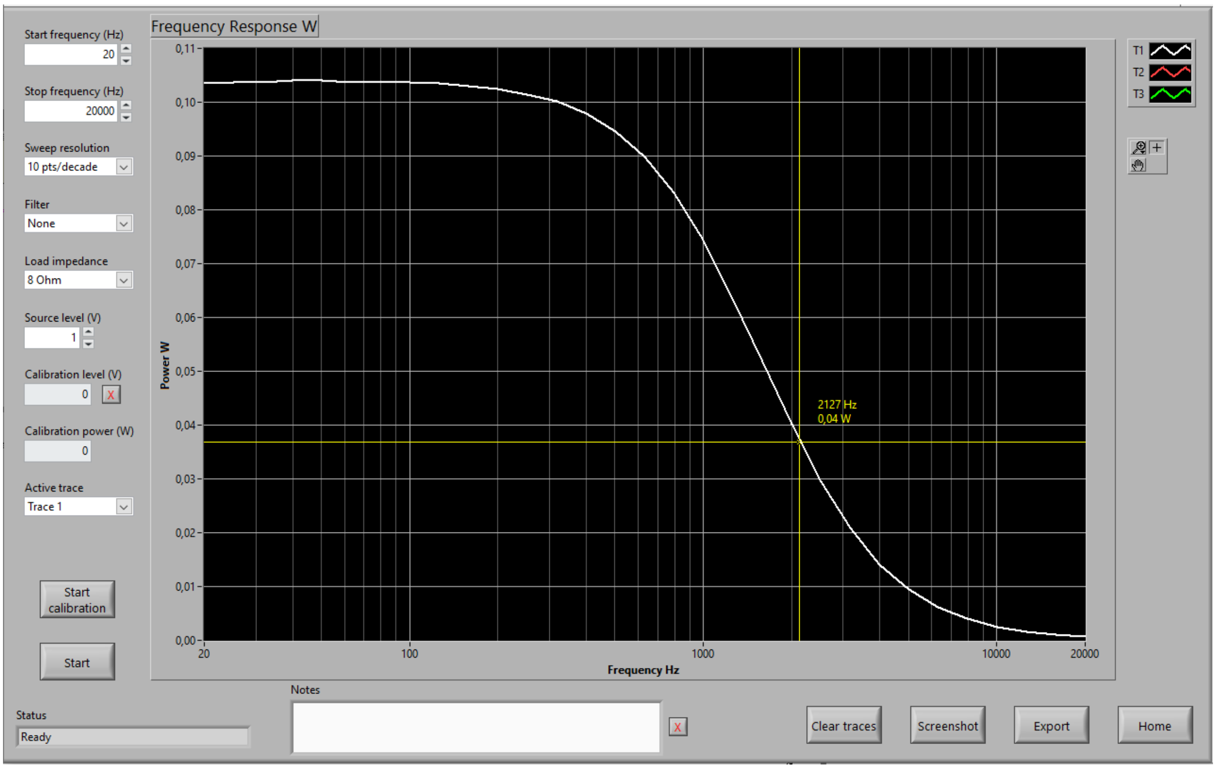
Frequency Response V



Refer to Frequency Response dB.

- Y axis shows absolute voltage.
- Calibration procedure is optional but recommended, the calibration level is not used.

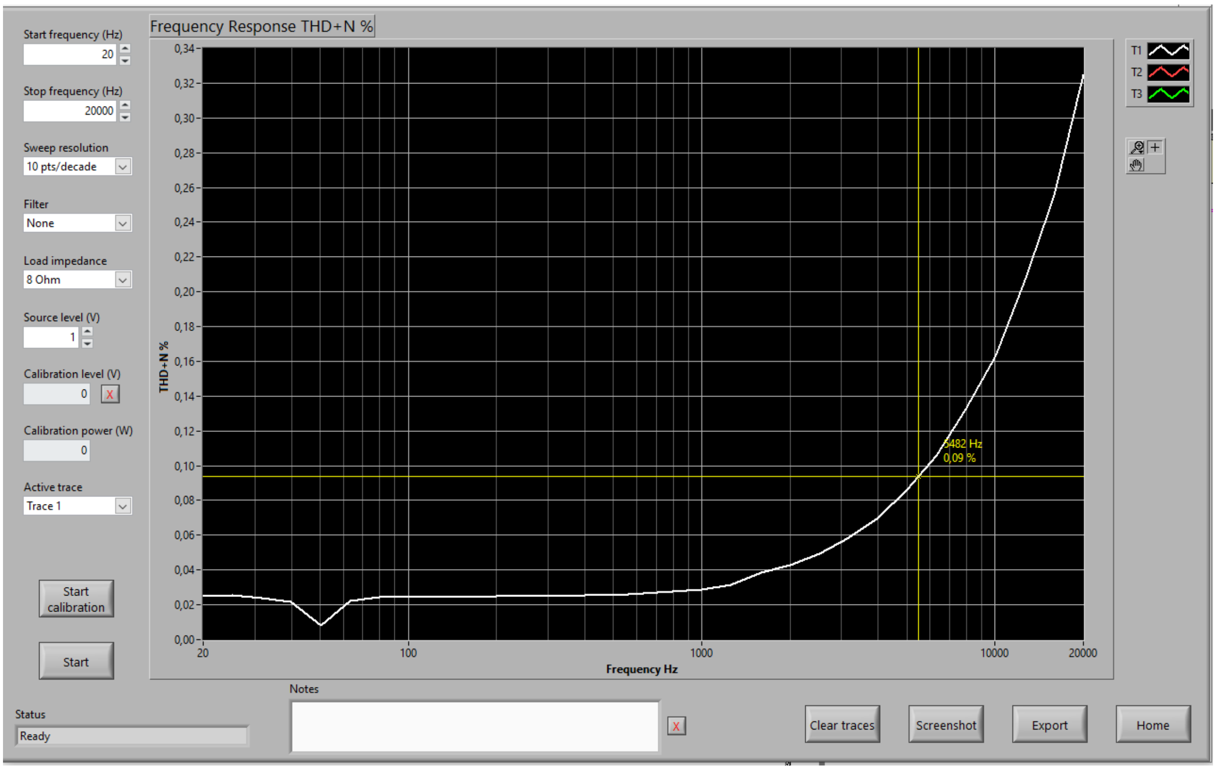
Frequency Response W



Refer to Frequency Response dB.

- Y axis shows power based on output voltage and load impedance setting.
- Calibration procedure is optional but recommended, the calibration level is not used.

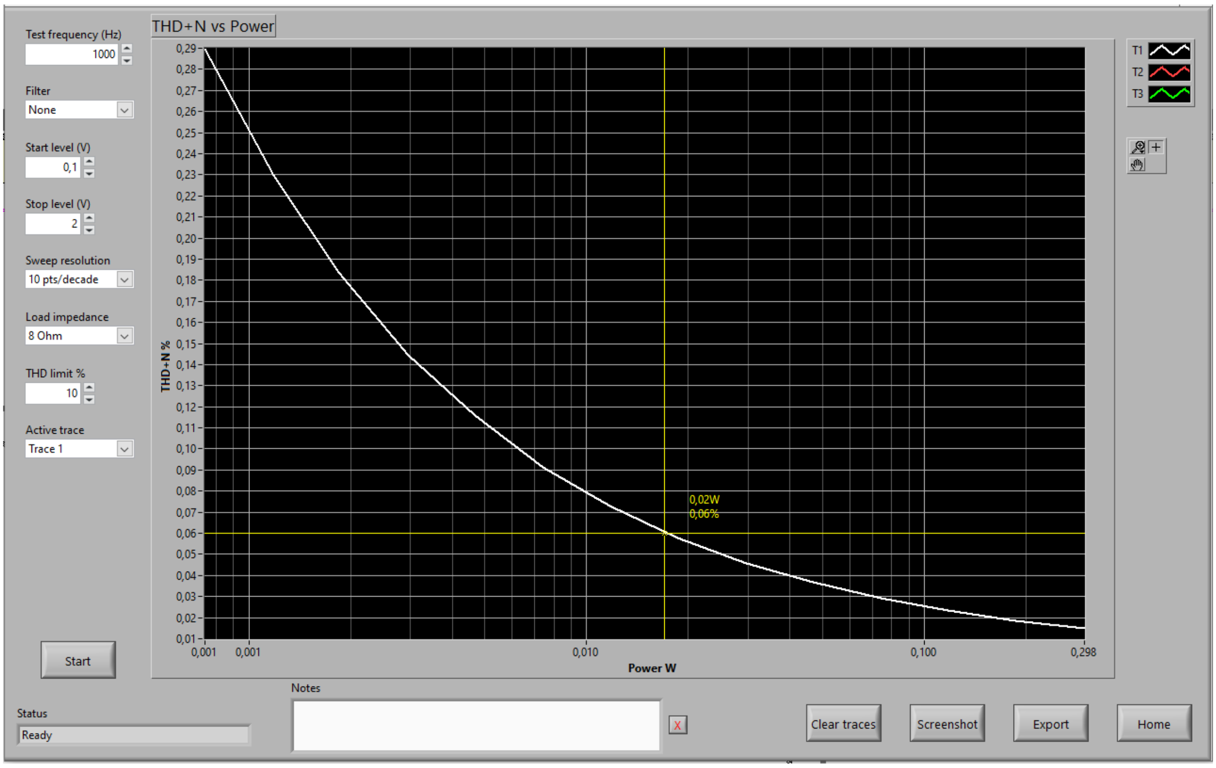
Frequency Response THD+N



Refer to Frequency Response dB.

- Y axis shows distortion.
- Calibration procedure is optional but recommended, the calibration level is not used.

THD+N vs Power



Test frequency

Set the frequency for the measurement, a voltage sweep is done at this fixed frequency.

Filter

Select one of the available filters, selection is limited to the two standard low pass filters, the other two filters are option based and not relevant for audio equipment.

Start level & Stop level

Set the output level range of the generator, because the intended use is audio equipment the range is limited to 2V rms to avoid clipping of the output of the DUT.

Warning: setting the stop level too high can cause clipping of the output signal of the DUT and may cause damage to it, set these levels carefully. The generator output is only turned on during the test cycle.

Sweep resolution

Select the number of measurement points per decade. More points means a higher resolution of measurement but increases test time. The source level sweep is logarithmic.

Load impedance

Select the load impedance on the DUT output, this value is used to calculate power output.

THD limit

Set the limit for the THD measurement. To protect the DUT, the measurement will abort once this level is exceeded.

Active trace

Select one of the three available traces for the next measurement, any previous measurements for the same trace will be overwritten.

Start

Click to start the measurement cycle.

Notes

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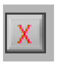

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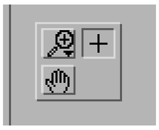

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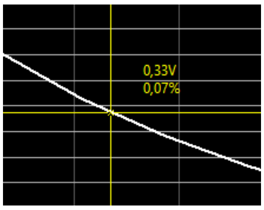

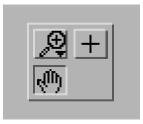

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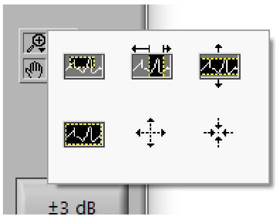

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Home

Return to the main screen.

THD+N vs Voltage

Refer to THD+N vs Power.

- X axis shows voltage.

Revision history

19/3/2024 first build V1.0