Installation and operation manual

Soneteste® Software

3.0

ATCP Physical Engineering

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Software for the supervision of ultrasonic welding machines, frequency analyses of ultrasonic devices and resonant ultrasound spectrometry.

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Sumário

1. Introduction

ATCP Physical Engineering software and equipment were designed and manufactured to last and provide top-rated performance. This Installation and Operation Manual contains all the necessary information regarding the use and maintenance of the Soneteste® Software.

⚠ ***Please read this manual carefully before using the software. Improper use may damage it and affect its performance.***

2. Definitions

Resonant ultrasonic spectroscopy: A non-destructive examination technique employing resonant frequencies to detect defects and assess variations in the mechanical properties of a test object or specimen (standard ASTM E2001).

Resonance frequencies: The natural frequencies of vibration associated with a test object or specimen.

Impulse excitation method: This method involves striking a test object or specimen with a mechanical impact to simultaneously stimulate one or more of its resonance frequencies.

Frequency analysis: The examination of a signal's frequency components and its temporal characteristics.

3. Applications and features

Soneteste® Software is dedicated to supervision of ultrasonic welding machines, frequency analyses of ultrasonic devices and resonant ultrasound spectrometry in accordance with the ASTM E2001 standard. Its primary applications include:

- Supervision of ultrasonic welding machines for early deviation detection.
- Determination of the operating frequency of ultrasonic cleaning equipment.
- Basic modal analysis of ultrasonic devices.
- Tuning of ultrasonic horns, sonotrodes, transducers, and acoustic transformers.
- Frequency Analyses and troubleshooting of power ultrasonic generators.
- Inspection of sintered powder parts for cracks and defects.
- Quality control of grinding wheels.
- Detection of defects and internal cracks by resonant ultrasonic spectroscopy (RUS).
- Quality control through acoustic signature.
- Frequency calibration of ultrasonic sources.

Soneteste® Software is a transient signals' analyzer from which it extracts the frequencies and the temporal dependence for resonant ultrasonic spectroscopy and frequency analysis. It identifies the natural frequencies of vibration by processing the object's acoustic response to mechanical impulse excitation and applies automatic acceptance criteria based on frequencies, number of peaks, frequencies ratios and spacings. Additionally, it offers results exportation and test report generation in PDF format.

4. Specifications

Frequency range .... 20 Hz - 192 kHz

Acquisition time.. 0.34 - 5.46 s

Number of programable judgement criteria............................... 25

5. System requirements

Compatible operating system................................. Windows 11

Sound card sampling rate[1]..................................... 48 kHz (minimum) - 384 kHz (maximum)

Free HD space... 4 Gigabytes

Available USB ports .... 01 port

Supported screen resolutions................................. 1280 x 720 and higher.

[1] Soneteste® Software digitizes the acoustic response using the signal acquisition USB modules ADAC+ and ADAC, or the signal acquisition PCIe card XONAR. The maximum measurable frequency is equal to half of the sampling rate.

Before installing the software, verify the followings items:

- The computer must be connected to a grounded three-pin AC plug in good condition.

- It is recommended to use Soneteste® Software in environments with moderate ambient noise. Intense ambient noises may affect the results.

6. Software and accessories installation

6.1 Installing the software for the first time

The following sub-items describe in detail the installation and updating processes for Soneteste® Software on compatible operational systems (see item *5. System requirements*), including the installation process of Soneteste® accessories. *Note: Soneteste® software is usually supplied with a DELL computer with the software already installed.*

Step-by-step Installation (Windows 11):

Step 01 – Use the installation flash drive or request the link for the installer by emailing info@atcp-ndt.com.

Step 02 – Locate the "Installer-Soneteste-1.0" folder, right-click on "setup.exe" and select "Run as administrator" (Fig. 1). It is advisable to close all programs before beginning the installation process.

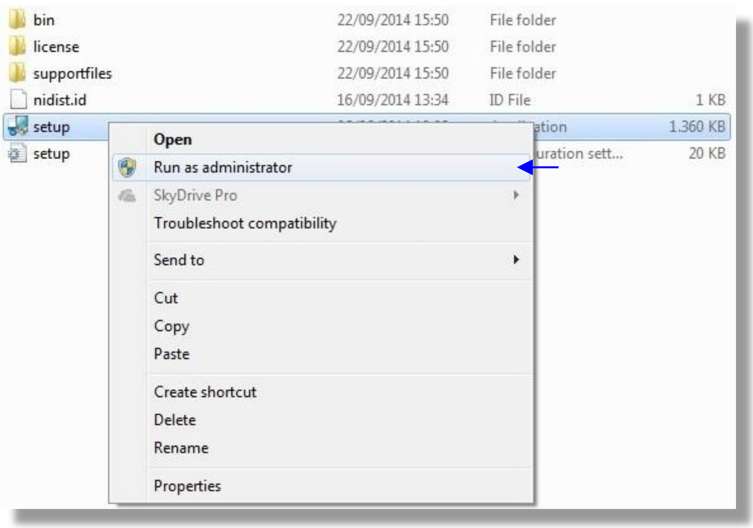


Figure 1 - Runing the installer as administrator.

Step 03 – Select "Yes" on the "User Account Control" window (Fig. 2).

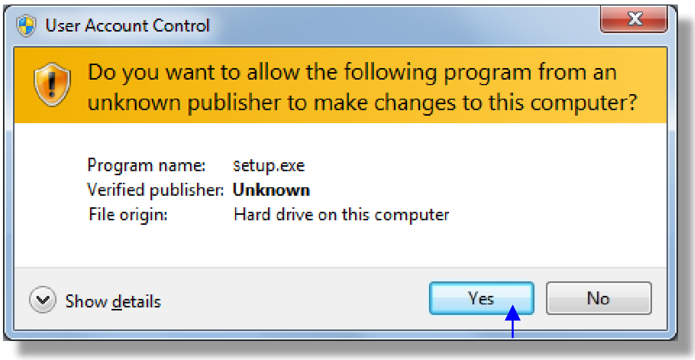


Figure 2 - Accepting the software installation.

Step 04 – Wait for the window below to close (Fig. 3).

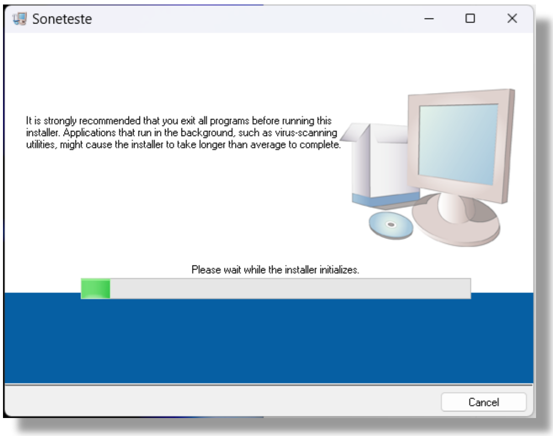


Figure 3 – Initialization window.

Step 05 – Select the destination directory folders where you wish to save the installation files. It is advisable to maintain the pre-selected directories. Click on "Next" (Fig. 4).

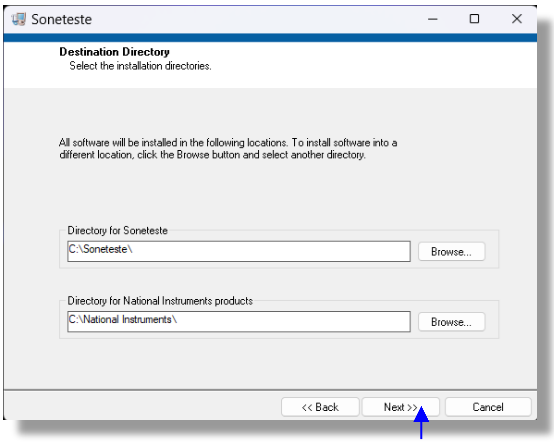


Figure 4 – Directory window.

Step 06 – Read the National Instruments Software License Agreement regarding the *plug-ins* used by Soneteste® Software. Accept the License agreement by selecting "I accept the above 2 License Agreement(s)", then click on "Next" (Fig. 5).

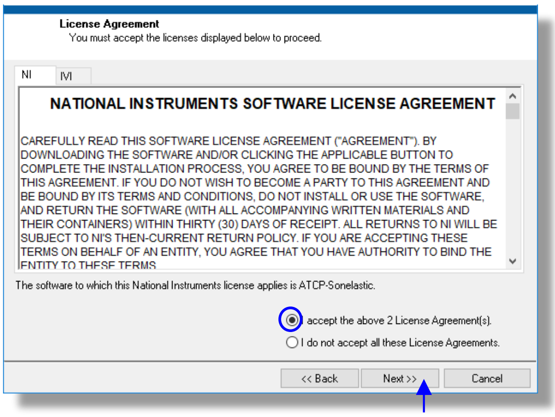


Figure 5 – National Instruments license window.

Step 07 – Click on the "Next" button to begin the installation (Fig. 6 & 7).

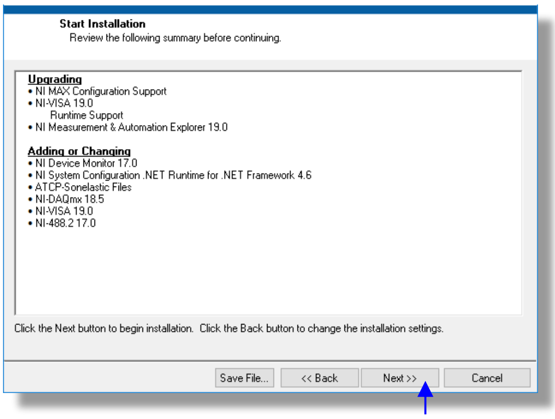


Figure 6 – Clicking on "Next" to begin installation.

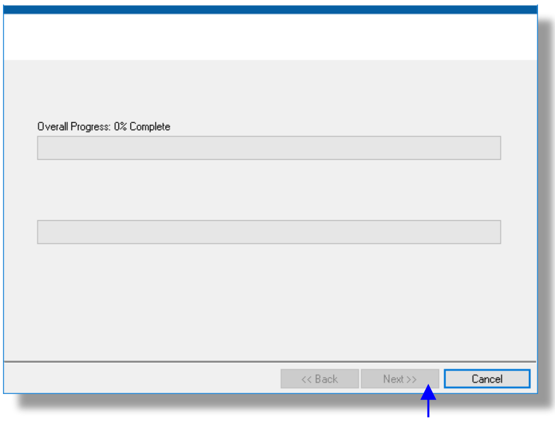


Figure 7 – After installation progress, clicking "Next" to finalize.

Step 08 – After installation, click on "Finish" and restart the computer.

Step 09 – Attribute administrator privileges to Soneteste® Software. To do this, right-click on the Soneteste® icon presented on the Desktop, then select "Properties" (Fig. 8).

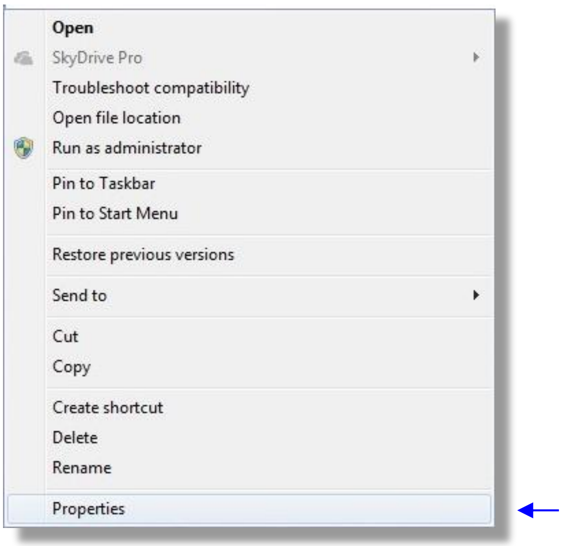


Figure 8 – Right clicking on the Soneteste® icon and then on "Properties".

Step 10 – Select the "Compatibility" tab and activate the option "Run this program as an administrator" (see Fig 9). For the cases of operating systems with more than one user, click on "Show settings for all users" and select the option "Run this program as an administrator". Click on "OK" to accept the changes.

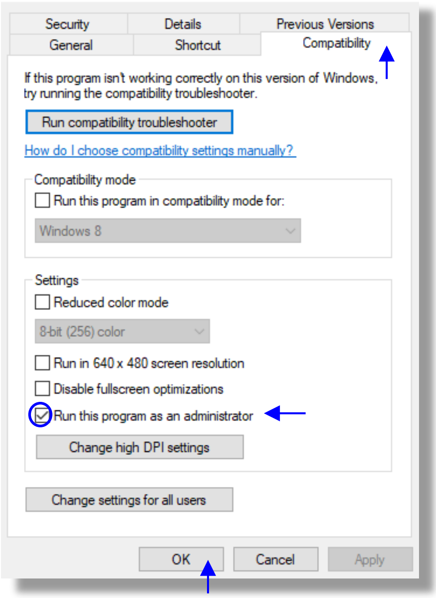


Figure 9 – Set to run the software as administrator.

Step 11 – Authorize file saving and modification. Select the "Security" tab and enable permissions for all users (use the Edit button shown in Fig. 10). Click the "OK" button to confirm the changes.

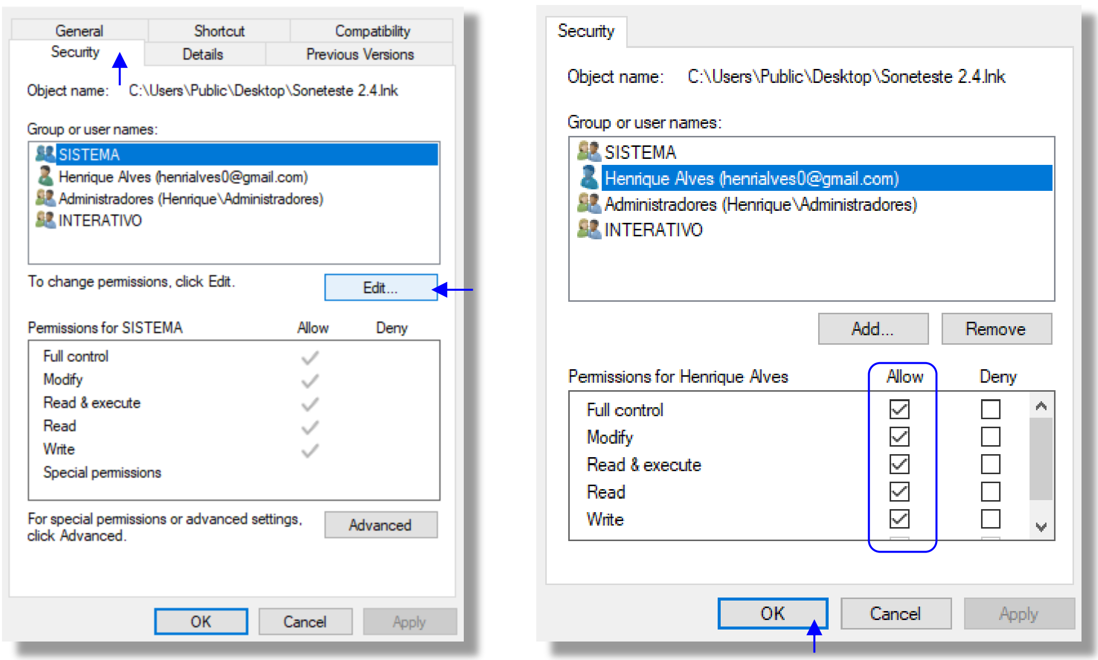


Figure 10 – Allowing the software to perform file changes for all users and groups.

Step 12 – Activate the software license. Before running the software, it is necessary to activate its license. For this, open Soneteste® Software and complete the following fields: "Name", "Enterprise", and "Contact" (e-mail address) as shown in Fig 11. After that, click on "Save File" to create an identification file. This file must be sent by email to ATCP Physical Engineering (info@atcp-ndt.com) to create the license file. A license will only be valid for the computer related to this file.

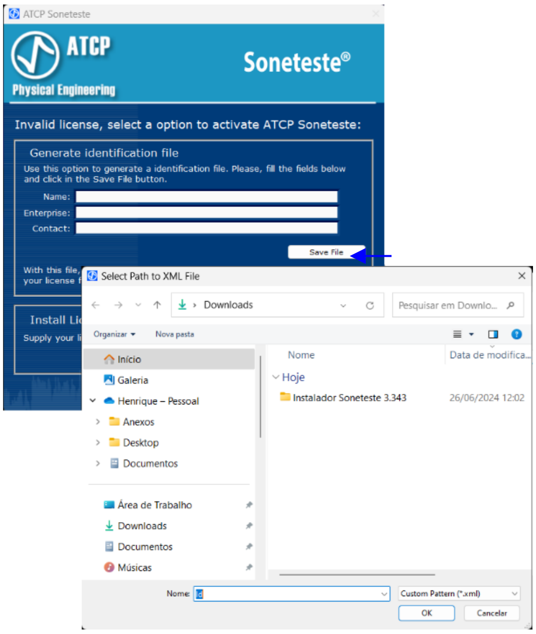


Figure 11 – Generating the identification file.

Step 13 - After receiving the license file, run the software and load the license file by clicking on "Activate Soneteste" (Fig. 12). The installation process is completed. Close Soneteste® Software and run it again, the program will be ready for use.

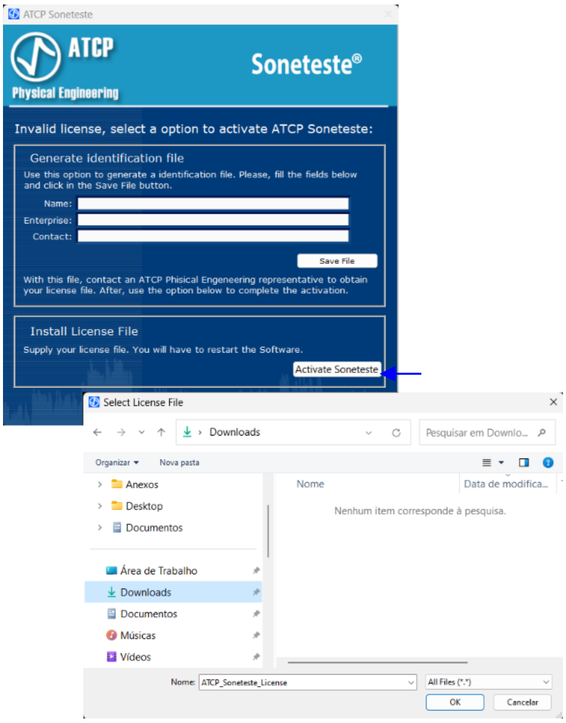


Figure 12 – Activating the software after receiving the license file.

6.2 Updating the Soneteste® Software

To update the Soneteste® Software, please follow these steps:

Step 01 – Open "Control Panel" and click on the link "Remove a program" under the option "Programs".

Step 02 – Find "Soneteste" in the list of system programs and features.

Step 03 – Right-click on the "Soneteste" icon and select "Uninstall". Follow the instructions to uninstall the software.

Step 04 – Install the new version of Soneteste® Software as described in *item 6.1 Installing the software for the first time*.

6.3 Connecting the acoustic sensor and configuring audio options

Step 01 – Connect the CA-PD or CA-DP-S Acoustic Sensor to the signal acquisition card or USB acquisition module.

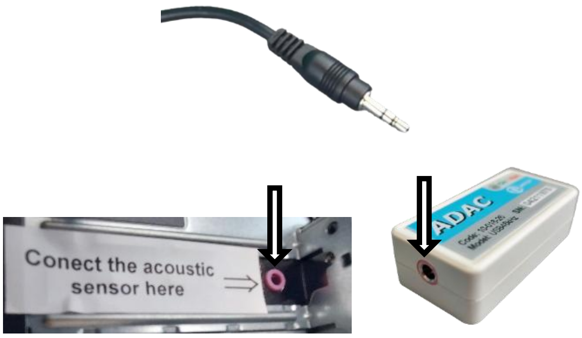


Figure 13 - Acoustic sensor TRS P2 / 3,5 mm plug, audio input from a XONAR acquisition board installed on the rear panel of a DELL computer, and audio input from the ADAC acquisition module.

Step 02 – Configure the audio options. To avoid any distortions with the acoustic response signal, ensure that both operating system and sound manager software do not optimize nor enhance the signal. In the Windows Notification Area, right-click on the Speakers/headsets icon.

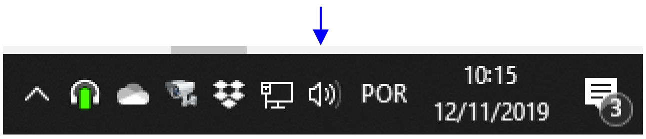


Figure 14 – Speakers/headsets icon.

Note: If this icon is not shown in the Windows notification area, it is possible to verify the sound configuration options by the Control Panel. Click on "Hardware and Sound", and then on "Sound", identified by a speaker icon.

Step 03 – Select "Sounds" on the menu.

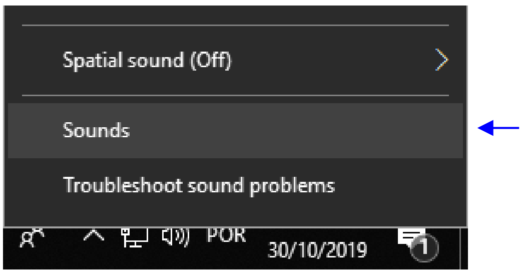


Figure 15 – "Sounds" menu.

Step 04 – In the "Sound" screen, select the "Recording" tab, then left-click on the "Microphone" symbol. After that, click on "Properties", as shown next (Fig. 16):

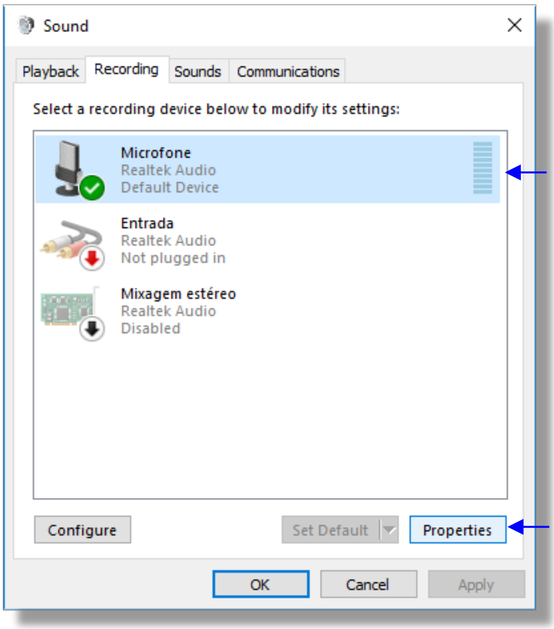


Figure 16 - Accessing the microphone settings.

Step 05 - Two types of sound configuration may appear. Follow the instructions below to perform all necessary changes for both cases. In the new window, select the "Advanced" tab or the "Enhancements" tab as described below. Unmark the "Enable audio enhancements" option or mark the "Disable all sound effects" option. Apply the changes by clicking "OK".

Step 06 – In the "Default Format" or equivalent field, select the mode with the highest available sampling rate (384000 Hz for ADAC+ module, 192000 Hz for XONAR and 48000 Hz for ADAC module).

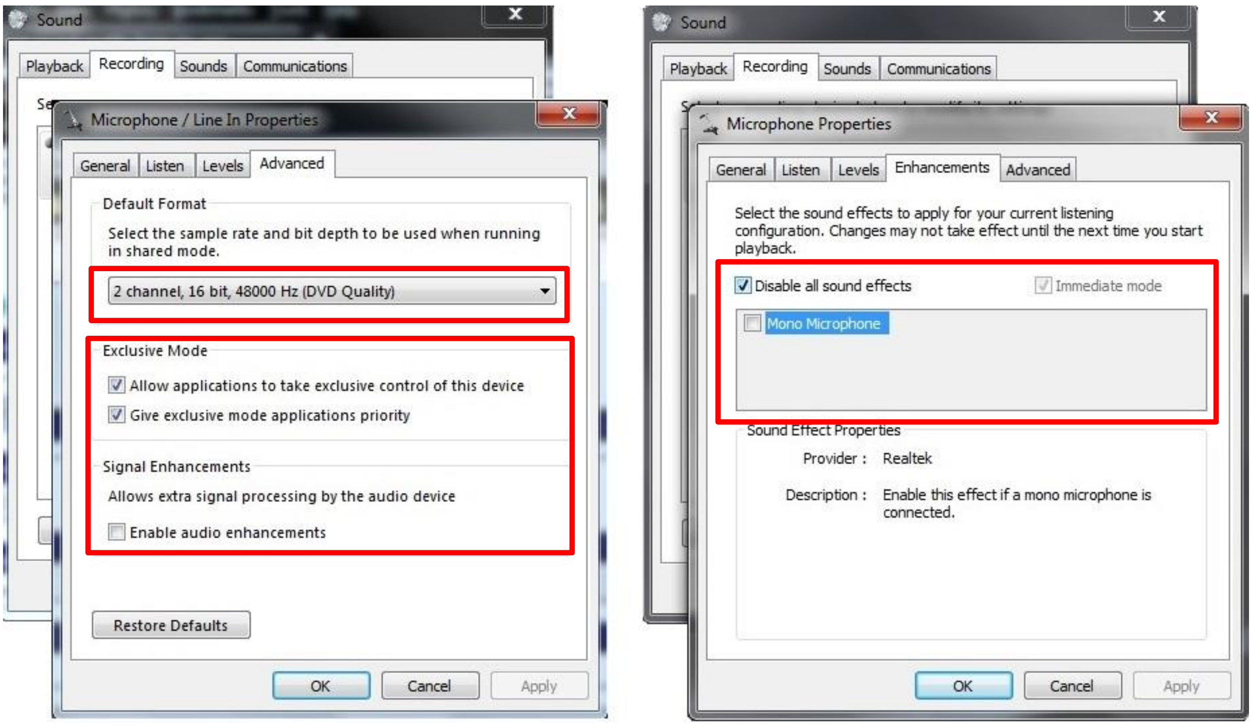


Figure 17 - Recording settings.

6.4 Installing the IED Automatic Impulse Device

Information regarding the installation and operation of the IED Automatic Impulse Device may be found on the Installation and Operation Manual supplied with the device.

6.5 Installing the specimen support

Information regarding the installation and operation of supports manufactured by ATCP Physical Engineering to be used with Soneteste® Software can be found on the Installation and Operation Manual of each support (SB-AP, SA-BC, SX-PD, and SA-AG).

Attention! The best support choice depends on the specimen dimensions. For further information, visit our website www.sonelastic.com or contact us (info@atcp-ndt.com).

7. Support, excitation, and acoustic sensing

Soneteste® Software can examine specimens, test objects, and ultrasonic equipment. Specimens may include rods, rectangular bars, discs, and rings made of raw materials, while test objects encompass various parts, elements, and finished products. Ultrasonic equipment comprises transducers, converters, acoustic transformers, boosters, sonotrodes, ultrasonic horns, ultrasonic tips, ultrasonic cleaners, ultrasonic welding machines, ultrasonic medical equipment, and general power ultrasonic equipment.

To undergo testing, specimens and test objects must be supported to enable them to vibrate as freely as possible. Ultrasonic cleaning machines, welding equipment, and medical equipment are typically self-supported and do not require additional support.

Once supported, the test specimen should be excited by an impulse excitation. For this purpose, a manual or automatic impulse device is required. The most important characteristic of the impulse device is its ability to provide excitation without generating frequencies that may interfere with frequency analyses. Ultrasonic cleaning machines, welding equipment, and medical equipment are self-driven, and external excitation is not required.

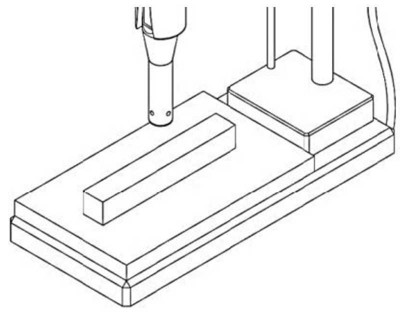
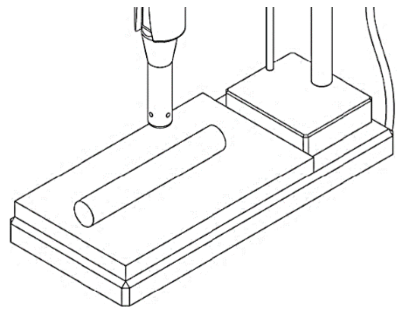
To capture the acoustic response or emission of the specimen, test object, or ultrasonic equipment, it should be converted to electrical signals compatible with the computer where the Soneteste® Software is installed. For this purpose, an acoustic sensor and signal digitization device are required.

7.1 Supports for specimens and test objects

ATCP Physical Engineering offers several models of support for basic geometric shapes. Below, you will find essential information about them, including the maximum and minimum dimensions of the specimen or test object for each model.

SB-AP - Support for small specimens
Maximum dimensions for cylindrical specimens (L x D) .... 120 x 60 mm
Minimum dimensions for cylindrical specimens (L x D) .... 20 x 2 mm
Maximum dimensions for rectangular specimens (L x W x T) .... 120 x 40 x 40 mm
Minimum dimensions for rectangular specimens (L x W x T) .... 20 x 2 x 2 mm
Maximum dimensions for discs and rings (D x T) .... 80 x 8 mm
Minimum dimensions for discs and rings (D x T)................................ 15 x 1 mm
In the SB-AP Support, the specimen is supported on a foam block over aluminum. For more information, see the SB-AP operation manual.

Table 1 – SB-AP support with some of the compatible geometries.

SA-BC - Adjustable support for bars and cylinders

Maximum dimensions for cylindrical specimens (L x D) .... 450 x 200 mm
Minimum dimensions for cylindrical specimens (L x D) .... 100 x 5 mm
Maximum dimensions for rectangular specimens (L x W x T) .... 450 x 170 x 170 mm
Minimum dimensions for rectangular specimens (L x W x T) .... 100 x 5 x 5 mm
For further information, verify the SA-BC installation and operation manual.

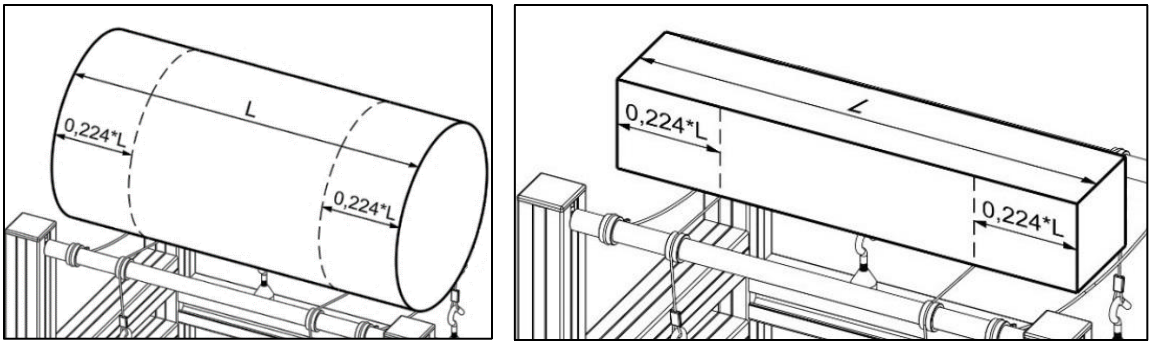


Figure 18 – SA-BC support with cylindrical and prismatic specimens.

SX-PD - Adjustable support for discs and rings

Maximum dimensions for circular specimens (D x T) .... 380 x 60 mm
Minimum dimensions for circular specimens (D x T) .... 80 x 5 mm
Maximum dimensions for rectangular specimens (L x W x T) .... 380 x 380 x 60 mm
Minimum dimensions for rectangular specimens (L x W x T) .... 60 x 60 x 5 mm
For further information, verify the SX-PD installation and operation manual.

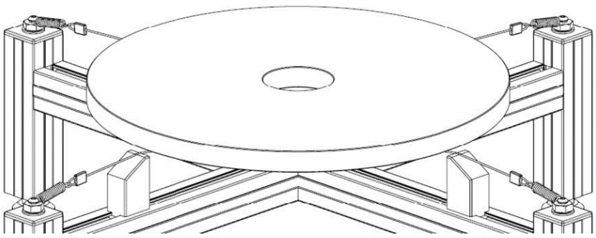


Figure 19 – SX-PD support with a ring-shaped specimen.

SA-AG - Adjustable support for large specimens

Maximum dimensions for rectangular specimens (L x W x T) .... 5,300 x 200 x 200mm
Minimum dimensions for rectangular specimens (L x W x T) .... 120 x 20 x 20 mm
For further information, verify the SA-AG installation and operation manual.

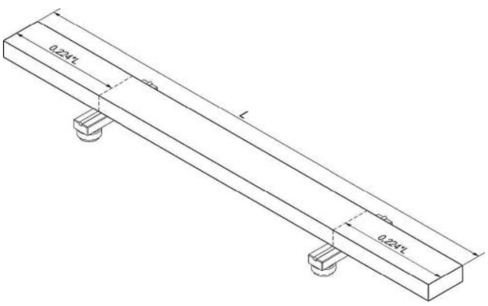


Figure 20 – SA-AG support with prismatic specimen.

Large size foam board

Maximum dimensions for rectangular and circular shapes................. 625 x 625 mm.
Besides basic geometric shapes, the foam board can also be used to support complex shapes.

Figure 21 – Large size foam board.

Medium size foam board

Maximum dimensions for rectangular and circular shapes................. 300 x 350 mm.
Besides basic geometric shapes, the foam board can also be used to support complex shapes.

Figure 22 – Medium size foam board.

7.2 Impulse excitation

ATCP Physical Engineering offers several models of impulse devices, available in manual or automatic types and different sizes. There are three manual models: Medium, Light and Extra Light, as illustrated in Fig. 23. All models have stainless steel impact tip, polymer or composite body and comply with ASTM-E1876 standard requirements.

Figure 23 – ATCP Physical Engineering manual impulse devices (Medium, Light and Extra Light).

The automatic models facilitate the impulse excitation procedure and enable automated measurements over time. They consist of a control unit and an electromagnetic impulse device, which may be light or medium, as depicted in Fig. 24. All models comply with ASTM-E1876 standard. The control unit of the IED Automatic Impulse Device allows for the application of an electrical pulse of adjustable duration and amplitude to the electromagnetic actuator, propelling its tip against the specimen surface. The control unit is remotely operated by Soneteste® Software via USB interface.

Figure 24 – ATCP Physical Engineering automatic impulse devices (Medium and Light).

7.2.1 Working principle

To provide excitation, the tip of the impulse device must be propelled against the surface of the specimen or test object. Upon impact, a momentary contact occurs, resulting in a force peak or mechanical impulse that excites the natural frequencies of vibration. The amplitude and duration of the mechanical impulse determine, respectively, the vibration amplitude of the specimen and the range of frequencies excited. Vibration amplitude is directly proportional to intensity, while the frequency range is inversely proportional to impulse/contact duration.

7.2.2 The impulse excitation intensity influence

The influence of the impulse excitation intensity on the frequencies results is usually negligible. However, a vibration amplitude too low may degrade the signal-to-noise ratio, making it difficult to process the acoustic response. Conversely, excessive excitation can potentially displace or damage the specimen. In specific cases, such involving refractory materials subjected to thermal shock damage and rich in cracks and microcracks, non-linearity in results can be up to 1%. To test the linearity of the specimen material, simply repeat the measurement while varying the intensity. If the material is linear, the results should be identical within the software's measurement uncertainty, typically ±0.1%.

7.3 Acoustic sensor and acquisition

The function of the acoustic sensor and acquisition device is to capture and digitize the specimen or test object acoustic response. The sensor should be directional and have high immunity to ambient noise to improve the signal to noise ratio and facilitate frequency identification. ATCP Physical Engineering offers two options for directional sensors suitable for high frequencies that meet these requirements, the CA-DP and CA-DP-S models, as shown in Fig. 25.

Figure 25 – ATCP Physical Engineering acoustic sensors, models CA-DP-S and CA-DP.

For the Soneteste® Software process the acoustic sensor signal from the acoustic sensor, it must be digitized by an acquisition device. For this purpose, ATCP Physical Engineering offers two options with sampling rate compatible with the typical applications frequency ranges: ADAC+ (USB), ADAC (USB) and XONAR (PCIe) models, as shown on Fig. 26 and Fig. 27.

Figure 26 – ADAC+ acquisition device, developed and manufactured by ATCP Physical Engineering. The maximum sampling rate of ADAC+ is 384 kHz.

Figure 27 – Acquisition card Xonar. Xonar's maximum sampling rate is 192 kHz.

In some applications, it may be necessary that the acoustic sensor and acquisition device to be calibrated with traceability to the International System of Units (SI) for frequency measurement. The calibration certificate applies to the set formed by an acoustic sensor and a signal acquisition device. In the case of the XONAR, calibration should be conducted with the card installed on a computer.

To support the acoustic sensor, ATCP offers two tripod models: medium and sturdy. The medium-sized tripod is suitable for both foam boards and ultrasonic machines, such as ultrasonic cleaners. The sturdy tripod is designed for large test objects and equipment. Figure 28 shows the medium-sized tripod.

Figure 28 – Medium-sized tripod.

7.4 Typical arrangements and applications

Following are some examples of typical applications of the Soneteste® Software, focusing on the arrangement of the acoustic sensor and the positioning of the test object or specimen.

7.4.1 For ultrasonic cleaners' frequency determination

The Soneteste® Software can determine the operating frequency of tabletop ultrasonic cleaners and general ultrasonic cleaning equipment. It can also obtain the frequency spectrum for cavitation analysis and detection of harmonic frequencies. The acoustic sensor can be positioned at an approximate distance of 15 cm from the tank surface, as shown in Fig. 29. This distance is not critical and can be increased if the signal is too intense and saturating the acoustic sensor or acquisition device.

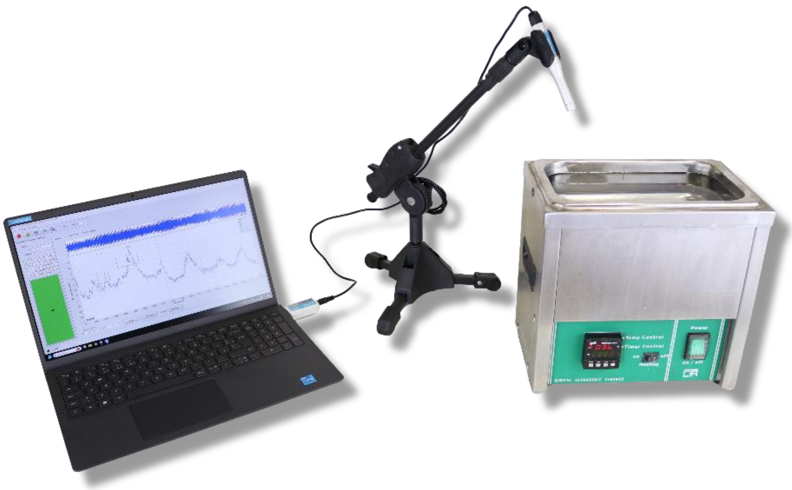


Figure 29 - Arrangement for determining the frequency of an ultrasonic cleaner.

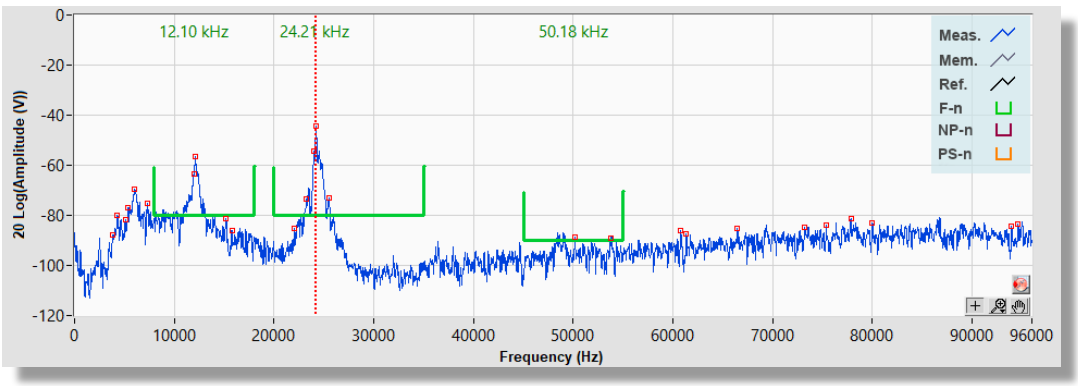


Figure 30 - Spectrum from the Fig. 29 ultrasonic cleaner obtained with Soneteste®. Note the main peak at 24.21 kHz (the nominal frequency is 25 kHz). The peak at 12.17 kHz is a subharmonic, and the multiple peaks between 5 and 10 kHz are due to cavitation noise.

The determination of the frequency of ultrasonic cleaners is particularly relevant for quality control, maintenance, and calibration in the medical field.

7.4.2 Supervision of ultrasonic welding machines

Soneteste® Software can determine and supervise the operating frequency of ultrasonic welding machines. The acoustic sensor can be positioned at an approximate distance of 15 cm from the sonotrode or ultrasonic horn, as shown in Fig. 31. This distance is not critical and can be increased if the signal is too intense and saturating the acoustic sensor or acquisition device.

Figure 31 – Arrangement of the Acoustic Sensor CA-DP for determining the frequency of a ultrasonic welder operating.

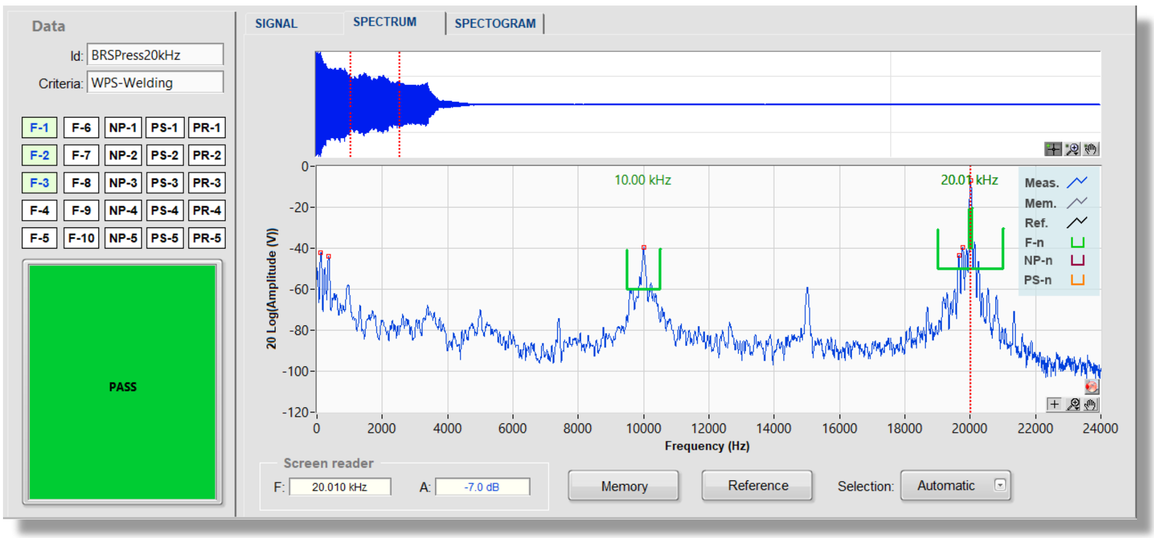


Figure 32 – A evaluation result from the continuous monitoring of the ultrasonic welder shown in Fig. 31 with Soneteste®. This spectrum is from the welding moment (note the subharmonic frequency at 10 kHz).

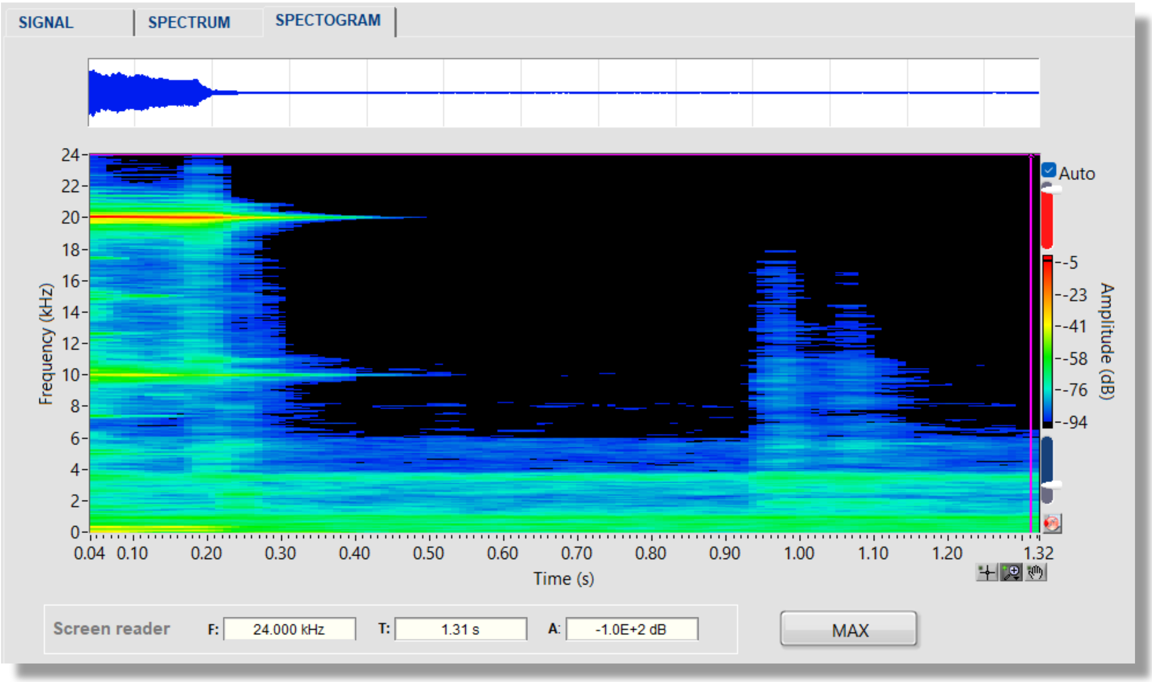


Figure 33 – Spectrogram of a welding cycle of the 20 kHz ultrasonic welder shown in Fig. 31, obtained with Soneteste®.

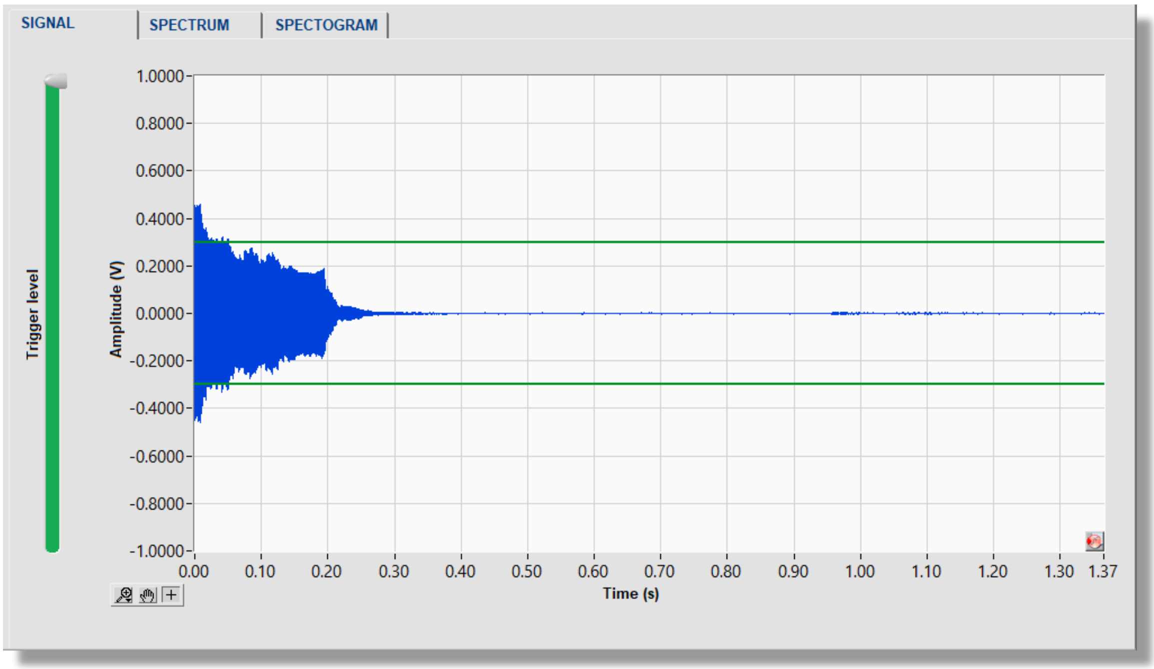


Figure 34 – Signal in time domain of a welding cycle of the 20 kHz ultrasonic welder shown in Fig. 31, obtained with Soneteste®.

The supervision of the frequency of ultrasonic welders is particularly relevant at the production line to early detect deviations and the need for preventive maintenance, thus avoiding downtime and scraps.

7.4.3 Basic modal analyses of ultrasonic devices

The Soneteste® Software can perform basic[1] modal analyses of ultrasonic stacks and ultrasonics devices such as transducers, boosters, sonotrodes, and tips. The acoustic sensor can be positioned at an approximate distance of 5 cm from the device, as shown in Fig. 35. This distance is not critical and can be adjusted if the signal is too low or saturating the acoustic sensor or acquisition device.

Figure 35 – Arrangement of the Acoustic Sensor CA-DP and medium-sized tripod for basic modal analyses of a 20 kHz ultrasonic welding stack.

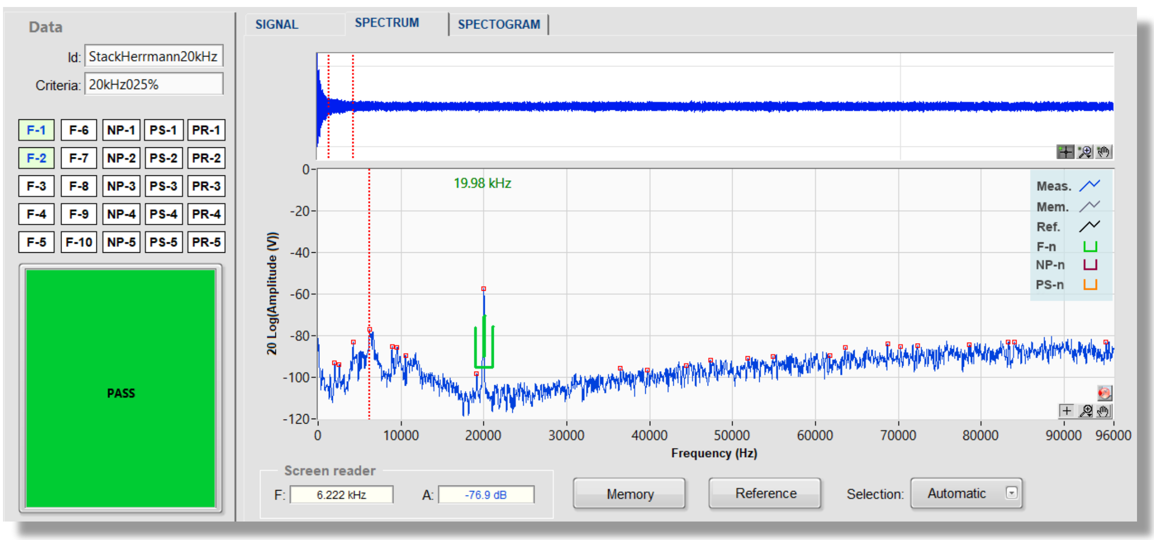


Figure 36 – Spectrum of the ultrasonic welding stack shown in Fig. 35, obtained with Soneteste®. The excitation was on the ultrasonic horn frontal face.

Modal analysis of ultrasonic devices is particularly relevant to decouple lateral modes of large sonotrodes.

[1] Since the excitation is not instrumented, the modal analyses performed by Soneteste® are limited to resonance frequencies.

7.4.4 Sonotrodes and ultrasonic horns tunning

The Soneteste® Software can be used in the tunning process of sonotrodes, ultrasonic horns, and ultrasonic tips without the need to couple these parts to a transducer or converter. The acoustic sensor can be positioned at an approximate distance of 5-10 cm from the device, as shown in Figure 37 (this distance is not critical).

Figure 37 - Arrangement for determining the frequency of a 20 kHz rectangular ultrasonic horn for tunning.

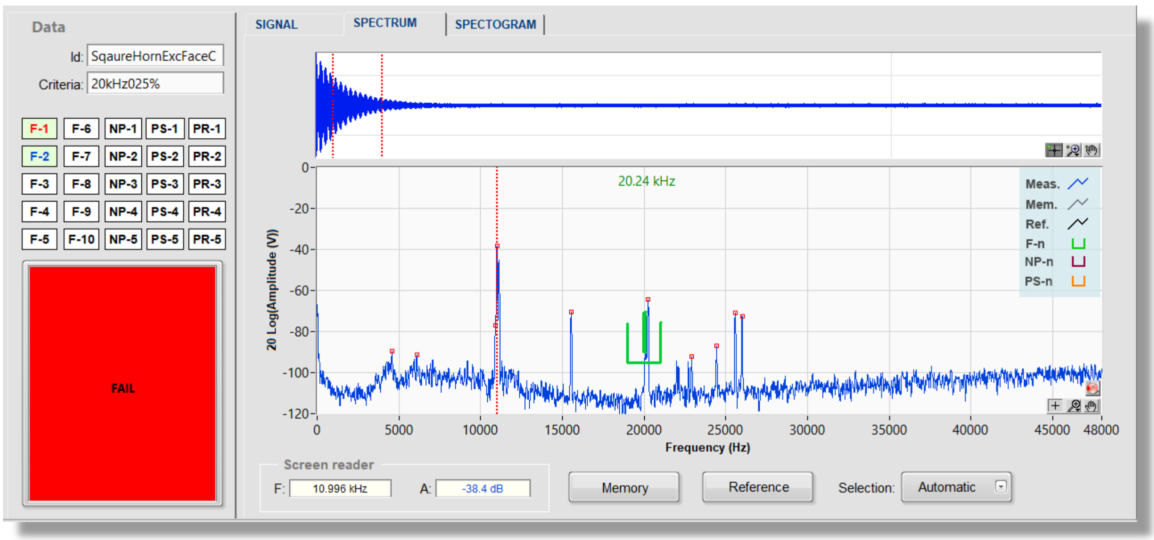


Figure 38 - Spectrum and spectrogram from the ultrasonic horn shown in Fig. 37, obtained with Soneteste®. The excitation was applied to the frontal face of the horn. The frequency measured is too high for a 20 kHz horn (20.24 kHz). The peaks around 11 kHz and 15.5 kHz are lateral modes.

7.4.5 Frequency analyses and troubleshooting of power ultrasonic generators

Soneteste® Software can determine and study the behavior of the operating frequency of ultrasonic generators. The acoustic sensor can be positioned at an approximate distance of 15 cm from the tip, sonotrode, or ultrasonic horn, as shown in Figure 39. This distance is not critical and can be increased if the signal is too intense and saturating the acoustic sensor or acquisition device.

Figure 39 - Arrangement for determining the frequency behavior of an ultrasonic dental scaler during start-up.

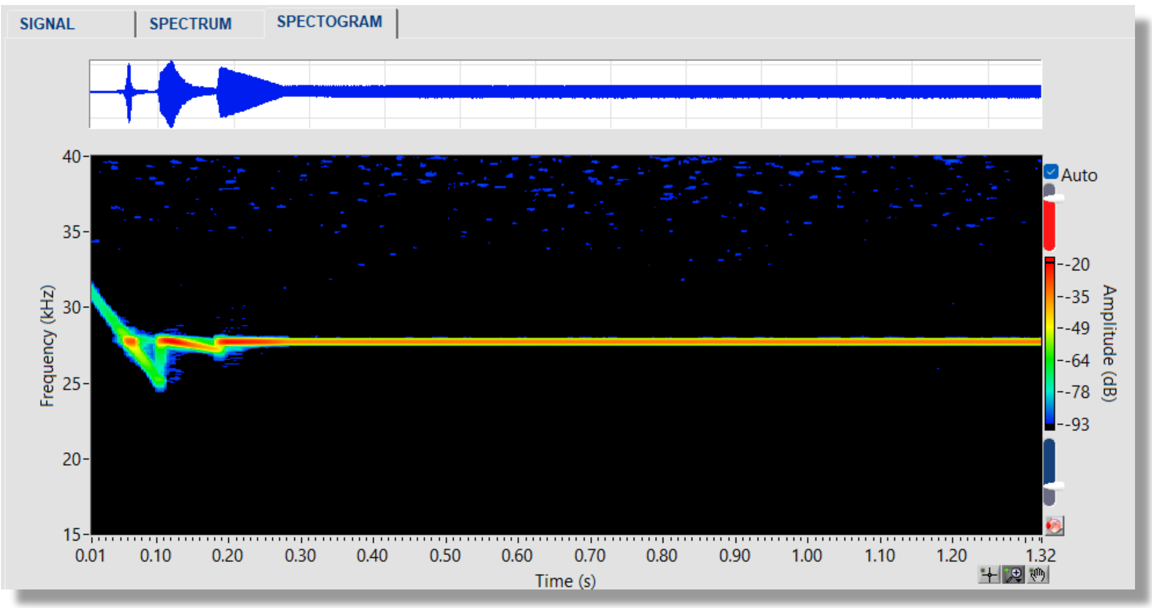


Figure 40 - Spectrogram of the equipment shown on Fig. 39 during start-up, obtained with Soneteste®. It is possible to identify a frequency sweep from 31 to 25 kHz between times 0.00 and 0.10 s, and a second one for refinement from 0.10 to 0.20 s. Subsequently, an amplitude adjustment is performed by the generator between 0.20 and 0.30 s, keeping the frequency fixed.

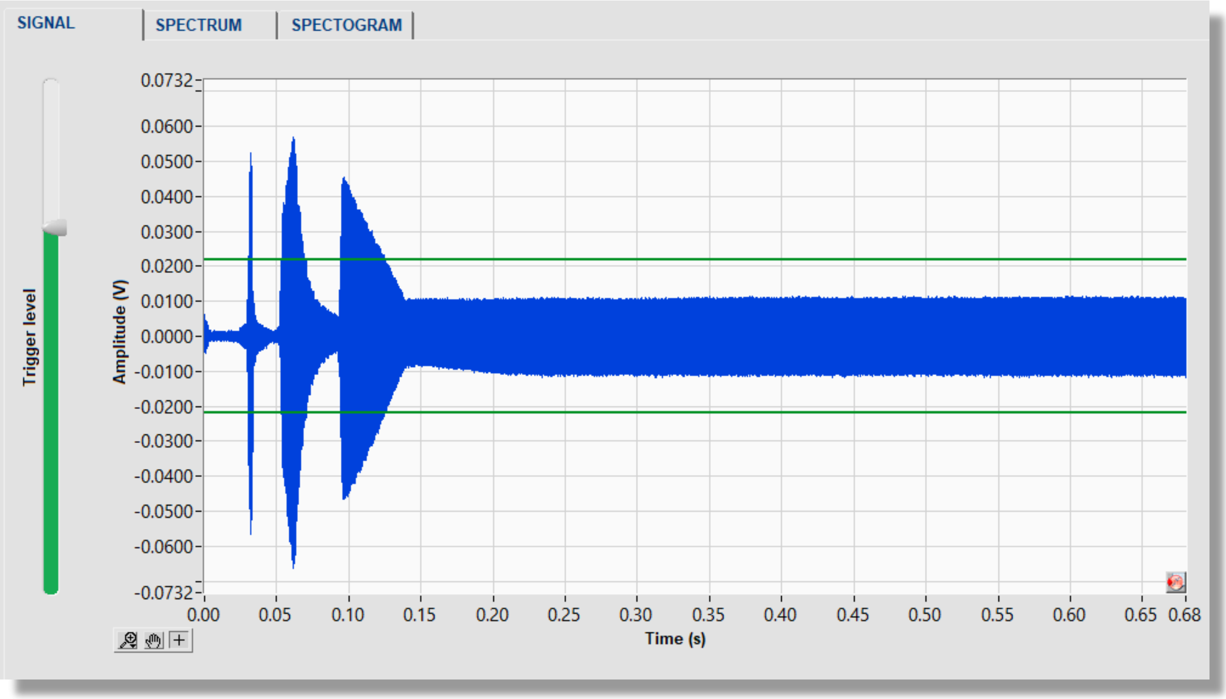


Figure 41 - Signal in time domain of the equipment shown in Fig. 39, obtained with Soneteste®. It is possible to observe the amplitude variation due to sweeps between 0.00 and 0.15 s, followed by amplitude stabilization after the time 0.15 s.

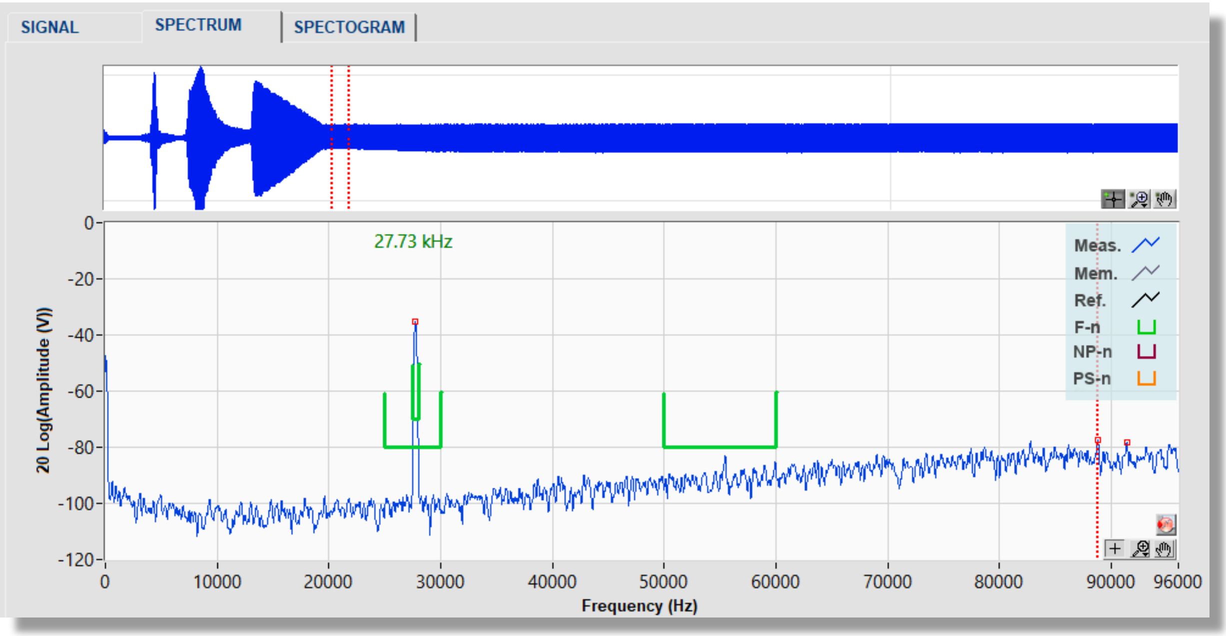


Figure 42 - Signal in time domain (upper part) and spectrum of the equipment shown in Fig. 39 after start-up sweeps, obtained with Soneteste®. It is possible to observe the amplitude variation due to sweeps between 0.00 and 0.25 s, followed by amplitude stabilization after 0.30 s.

The sonogram (Fig. 40) is particularly useful for the development of automatic tuning power ultrasonic generators.

7.4.6 Inspection of sintered powder parts for cracks and defects

The Soneteste® Software can be used to inspect sintered parts for crack detection by Ultrasonic Resonance Spectroscopy. The acoustic sensor can be positioned at an approximate distance of 1-5 cm from the device, as shown in Figure 43 (this distance is not critical).

Figure 43 - Arrangement of the Acoustic Sensor CA-DP and SB-AP support for determining the resonance spectrum of a sintered powder metal part.

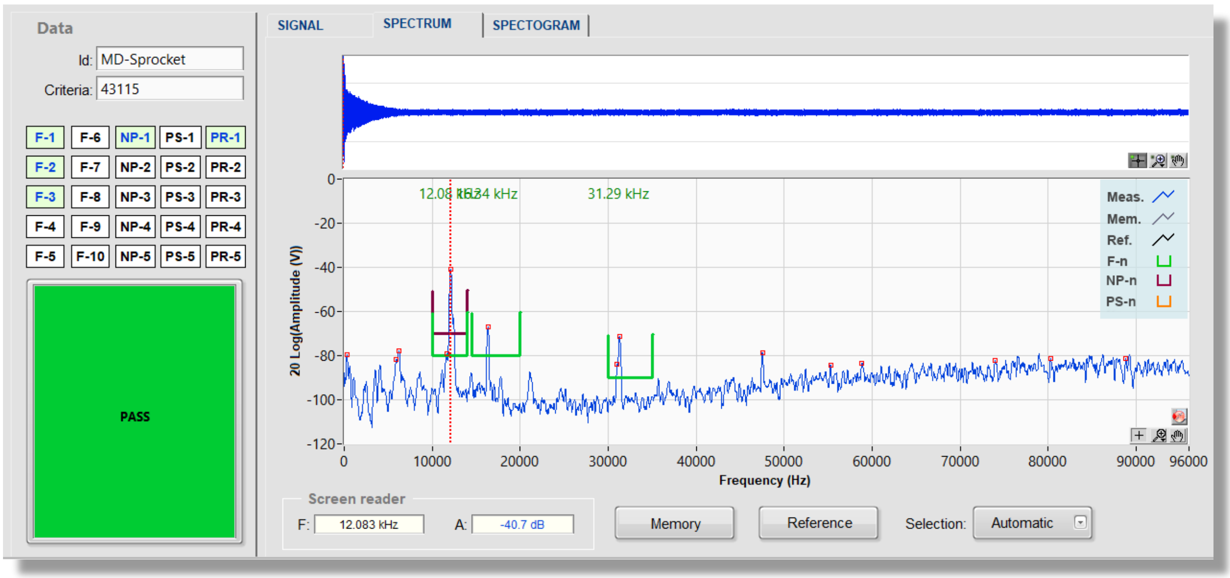


Figure 44 - Spectrum of the part shown in Figure 43, obtained with Soneteste®. Excitation was applied on the side of the gear. The judgment of the result was based on the frequencies (F1, F2, and F3), number of peaks (NP-1), and frequencies ratio (PR-1).

7.4.7 Quality control of grinding wheels

The Soneteste® Software can be used to inspect grinding wheels for crack detection by ultrasonic resonance spectroscopy. The acoustic sensor can be positioned at an approximate distance of 1-5 cm from the device as shown in Figure 45 (this distance is not critical).

Figure 45 - Arrangement of the CA-DP Acoustic Sensor and SX-PD support for determining the resonance spectrum of a small grinding wheel.

The evaluation of results may be based on frequency, number of peaks, and frequency ratio criteria (Fig. 46). The number of peaks allows for crack detection by frequency splitting, while the frequencies ratio criteria reduce the influence of apparent density.

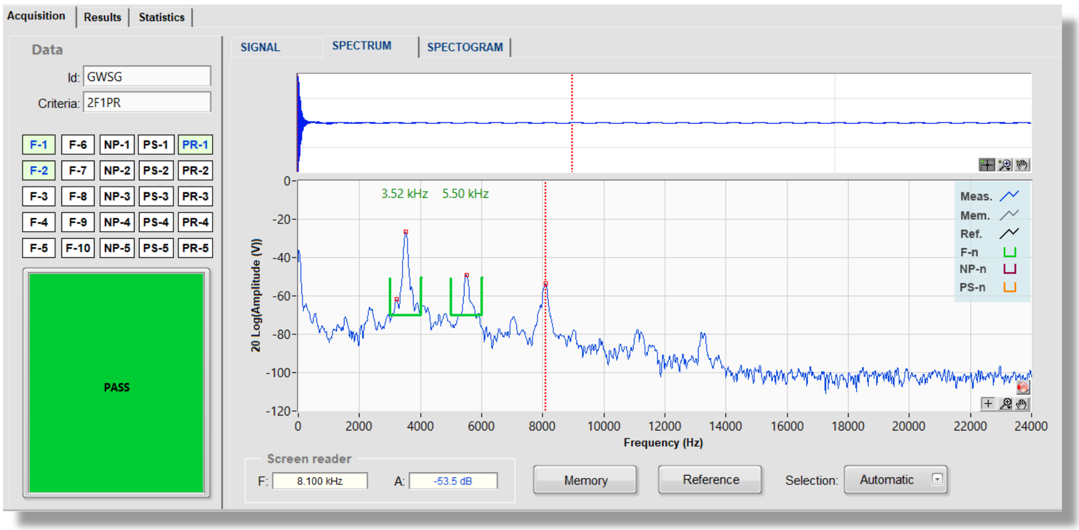


Figure 46 - Spectrum from grinding wheel shown in the Figure 45, obtained with Soneteste®. The result judgment was based on the detected frequencies (F1 an F2) and frequencies ratio (PR-1).

8. Software elements and operation

Before starting operating the software, verify the following:

- The Soneteste® Software is installed.

- The specimen or test object and the acoustic sensor are positioned as described in the topic *7*.

- The IED Automatic Impulse Device is on and correctly installed (if applicable).

After verifying the items above, the system is ready.

Soneteste® Software is structured in menus, main buttons, interfaces, tabs, and sub-tabs as shown in Figure 47.

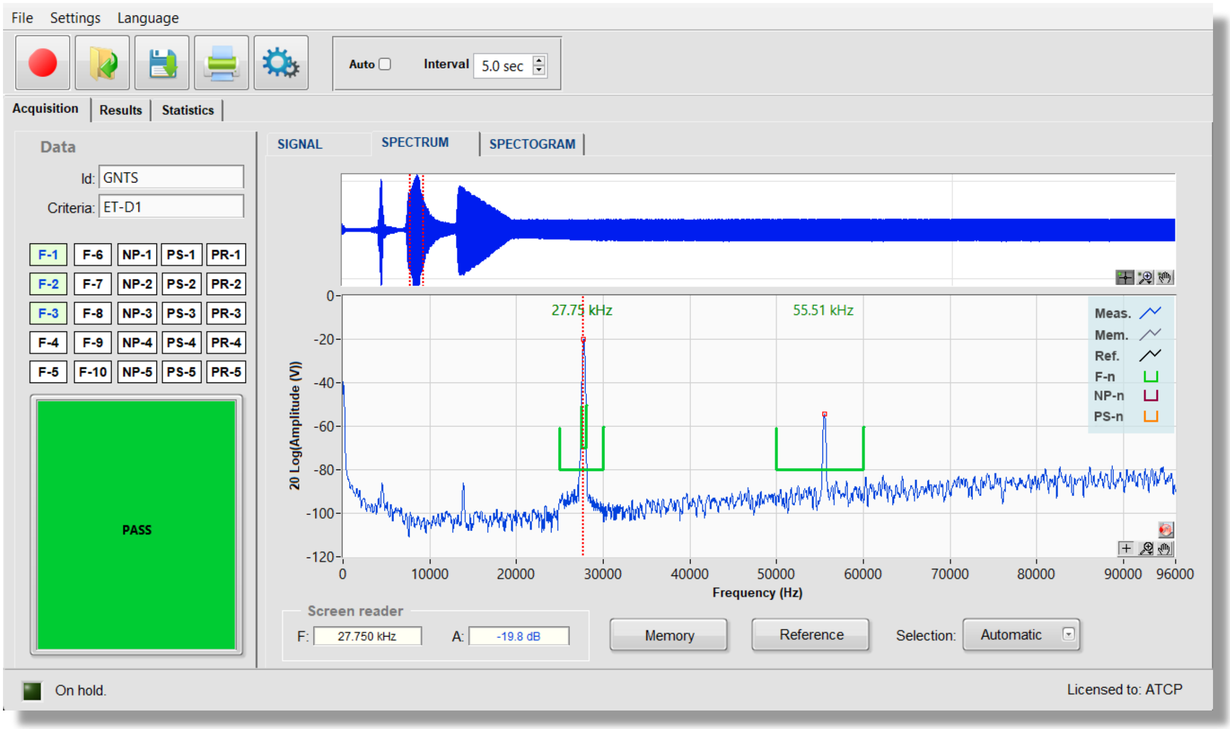


Figure 47 - Soneteste® Software main screen, showing the Acquisition tab and SPECTRUM sub-tab.

Soneteste® Software was developed to provide an easy and interactive way to test specimens and test objects. Next, all the information regarding the Soneteste® Software elements, configuration, and operation is presented. *Note: A quick guide for measurements using Soneteste® Software is on Topic 9.*

8.1 Menus

Soneteste® Software has three menus: File, settings, and language, as shown in Fig. 48 and detailed next.

Figure 48 - Soneteste® Software menus.

8.1.1 File menu

The "File" menu (Fig. 49) and its shortcuts are an alternative for saving and loading files, as well as to exit the application. Click on "Load" to load a previous saved file and "Save" to save a measurement. It is also possible to close Soneteste® Software window by clicking on "Exit".

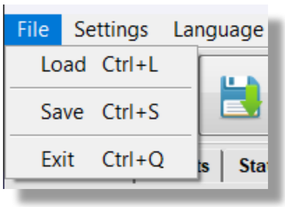


Figure 49 - File menu.

8.1.2 Settings menu

In the "Settings" menu (Fig. 50), it is possible to activate signal simulation, control the display of the overall judgment result and the display of detected frequencies on the graph. It is also possible to have the R parameter shown instead of the frequency (R= 2000000/F), enable loading of the last measurement when opening the software and enable remote communication.

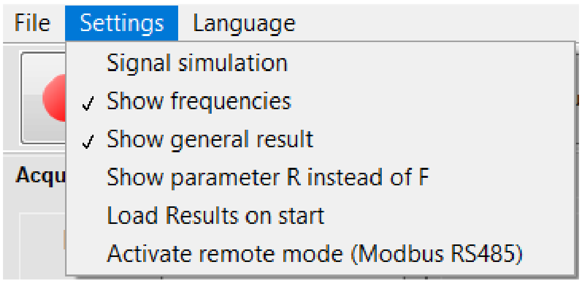


Figure 50 - Settings menu.

The Signal simulation feature allows the user to simulate a signal using the interface shown in Fig. 51. When the acquisitions occur, the acquired signal will be replaced by the simulated signal.

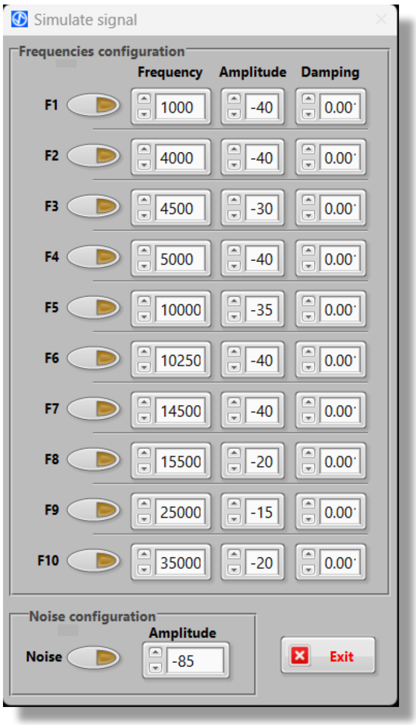


Figure 51 - Signal simulation interface. It is possible to add noise and up to 10 frequencies with adjustable amplitude, frequency, and damping.

The "Show frequencies" options activate the graph labels for the detected frequencies above and aligned to the peaks as shown on Fig. 52.

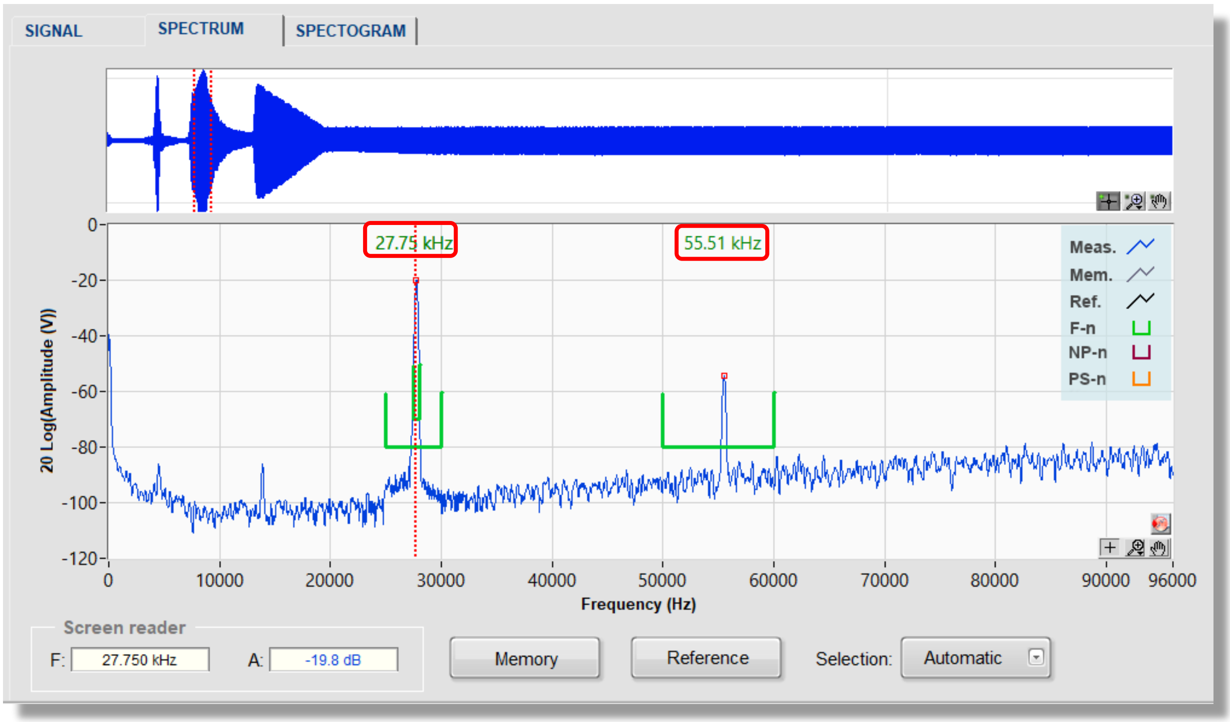


Figure 52 - The "Show frequencies" option in the "Settings" menu activates the labeling in the SPECTRUM sub-tab, as exemplified in this figure.

8.1.3 Language Menu

It's possible to change the main language of Soneteste® Software by selecting one of the options in the 'Language' menu (Figure 53). The available options are English, Spanish, and Portuguese.

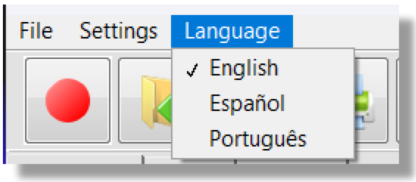


Figure 53 – Language Menu.

Soneteste® Software is structured in tabs and sub-tabs that perform the sequential processing of the acoustic response and present the results, as shown in Figure 45 and the following fragments.

8.2 Main buttons and controls

Soneteste® Software has a set of main buttons and controls shown in Figure 54, listed in Table 2, and detailed below.

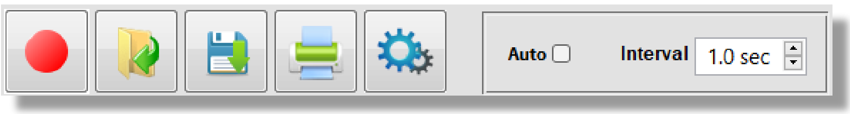
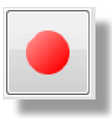
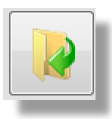
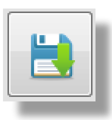
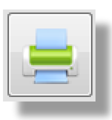
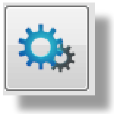
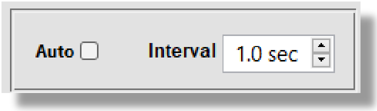


Figure 54 - Soneteste® Software main buttons: signal acquisition, load file, save file, print report, acquisition settings and auto mode controls.

Table 2 - Soneteste® Software main buttons functions.

	**Signal acquisition (keyboard shortcut: F1):** Triggers a new signal acquisition. The signal acquisition recording will start when the signal crosses the trigger level.
	**Load file:** Allows you to load a file of a previously saved signal acquisition along with the respective criteria and settings.
	**Save file:** Allow you to save a signal acquisition in a file. The current criteria and acquisition settings are included.
	**Print report:** Open a interface for data input to generate a test report in PDF format.

	**Acquisition and IED settings:** Access the Acquisition and IED settings interface.
	**Auto mode ("Auto" checkbox /keyboard shortcut: F2):** Check the "Auto" box and adjust the "interval" to the software trigger new signal acquisitions automatically after the interval time is elapsed.

8.2.1 Starting a signal acquisition

To start a new signal acquisition, click on the button  (F1). The software will initiate continuous acquisition and be prepared to record when signal amplitude crosses the trigger level. If the IED Automatic Impulse Device is connected to the computer, it will provide the programed impulse excitation. If the IED Automatic Impulse Device System is not available, perform the impulse excitation by using a manual impulse device.

The acquired acoustic response will be shown in the SIGNAL sub-tab as an amplitude graph plotted against time. Verify the obtained graph and perform any necessary adjustments according to item 8.2.3 Configuring the signal acquisition.

8.2.2 Generating a test report

To generate a test report, click on the button . It will access the interface shown in Fig. 55 to input the test information. At this interface, click on "Print" and designate the file direction when prompted to the software to generate the text report. An example is shown in Figure 56.

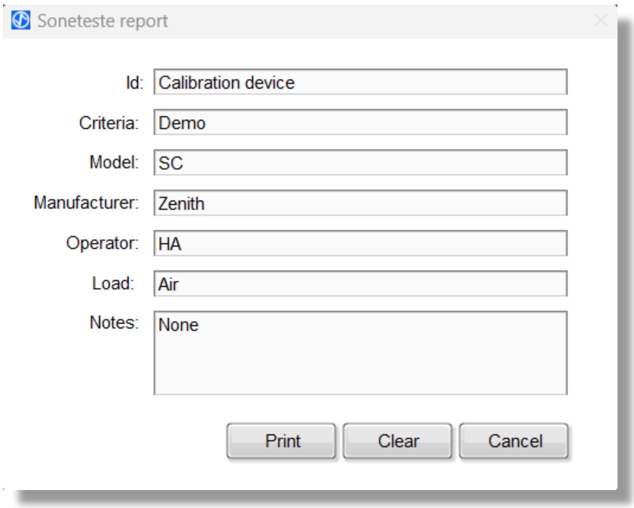


Figure 55 - Data interface for the test report.

SONETESTE REPORT

Id: USCleaner-D40XA-25kHz-CTA-24-06-25-15h20
Criteria: D40XA-25kHz-CTA
Model: D40XA-25kHz
Manufacturer: CTA
Operator: HA
Load: Water
Date: 25/06/2024 15:20
Notes: None

Parameters
Acquisition time (s): 1.365
Processing time (ad.): 5
Sample rate (Hz): 192000

Overall result:
PASS

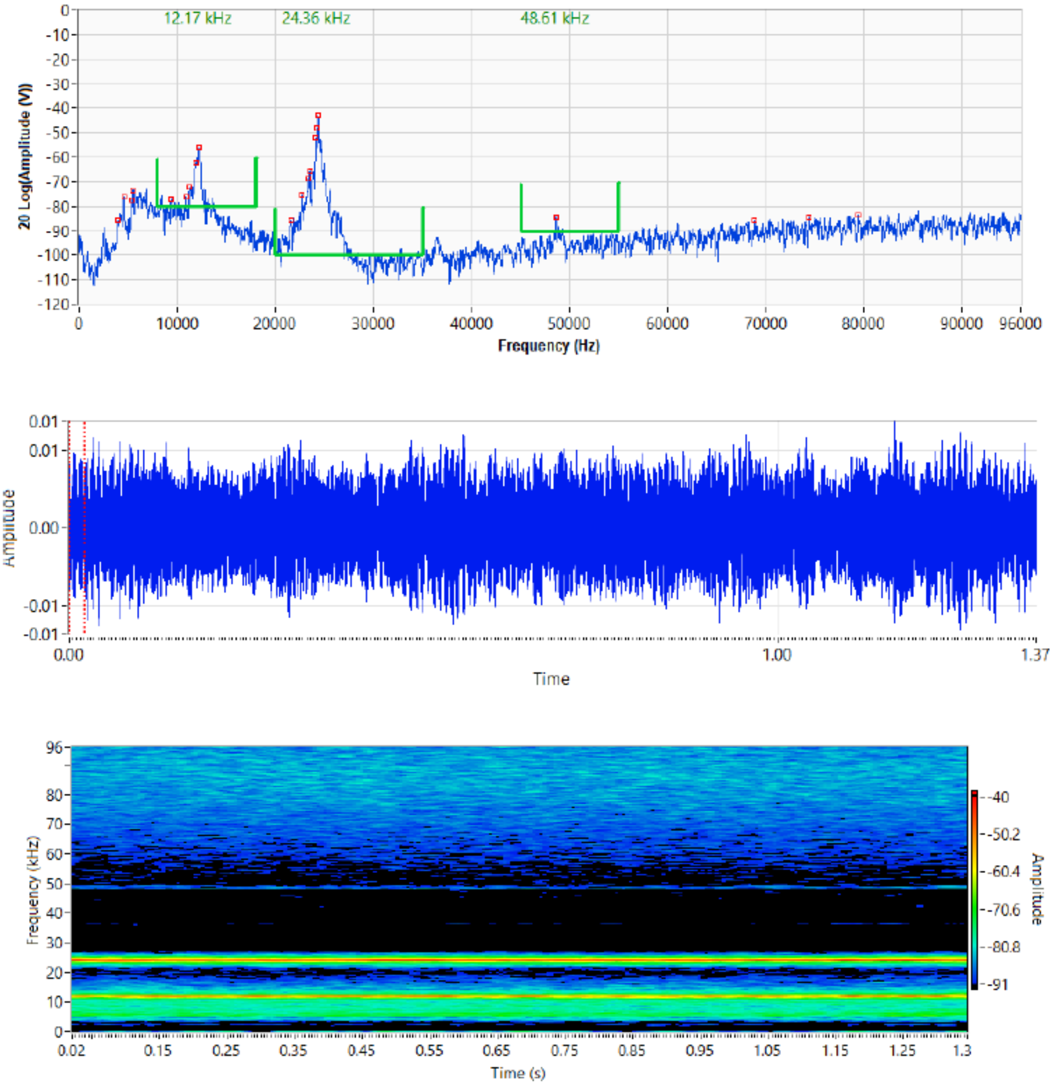


Figure 56 - Example of test report generated by Soneteste® Software.

8.2.3 Configuring the acquisition and IED settings

To access the configuration interface shown on Figure 57, click on the button  .

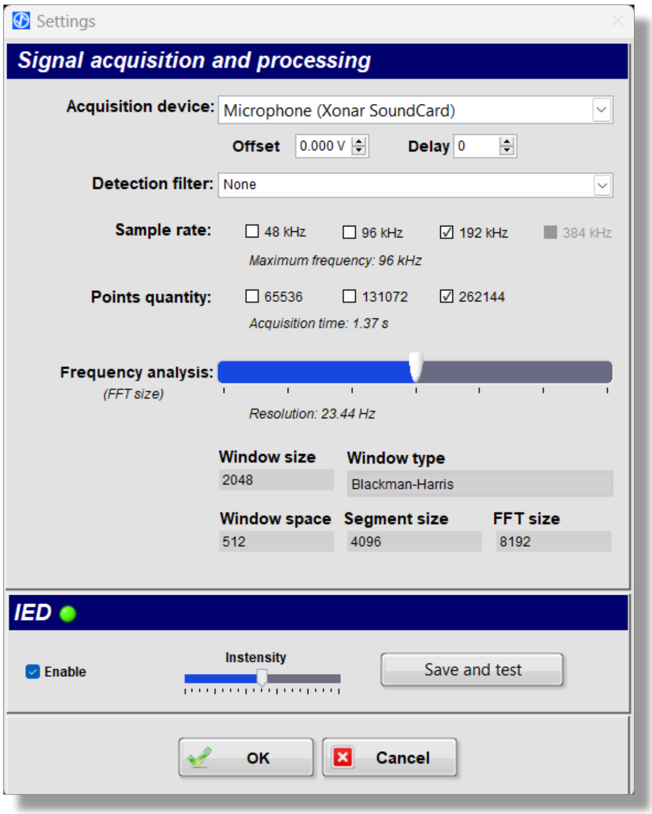


Figure 57 - Signal acquisition and processing configuration interface.

In the "Acquisition device" (Fig. 58), one can select the signal source. Click the arrow on the right to access the options. If a new source is connected after the software has already started, choose "update" in the list.

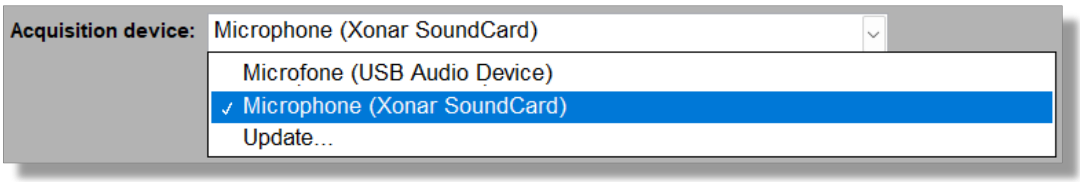


Figure 58 - Field for selecting the signal acquisition source.

In the "Detection filter" field (Fig. 59), one can reduce the influence of the environment noise on the signal acquisition triggering by selecting one of the frequency ranges. It's important to note that the filtering process is exclusively applied to the signal preceding the acquisition triggering, ensuring that the acquired signal remains unaffected by the filter.

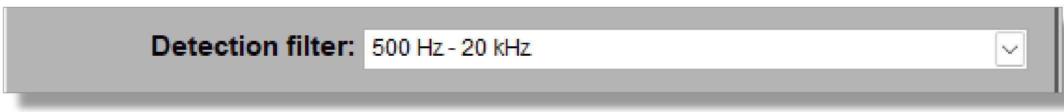


Figure 59 - Field for selecting the frequency range to trigger the acquisition.

In the "Sampling rate" field (Fig. 60), one can select the rate at which the signal is sampled during acquisition. For small specimens with high frequencies, it's recommended to choose higher sampling rates, such as 192 kHz. Ensure that the selected rate aligns with the specifications of both the acquisition device and the acoustic sensor. The maximum detectable frequency is half of the sample rate and is displayed below the available options for reference.

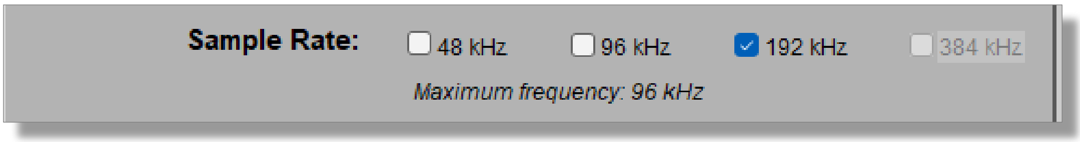


Figure 60 - Field for selecting the sample rate.

Next, in the “Points quantity” field (Fig. 61), on can specify the total number of data points acquired. The “Acquisition time” depends on the ratio between the “Points quantity” and the “Sample rate” and is displayed below the available options.

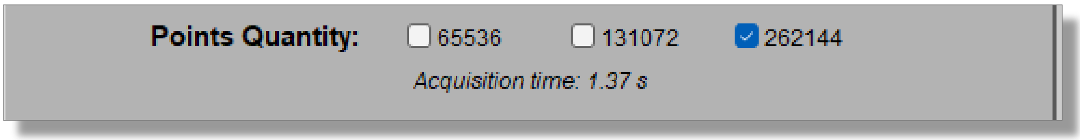


Figure 61 - Field for selecting “Points quantity” (number of points).

Moving on the “Frequency analysis” field (Fig. 62), one can adjust the Fast Fourier Transform (FFT) resolution. A higher FFT resolution increases the accuracy of frequency determination. However, it may result in a coarser spectrogram, making it challenging to discern nearby or weak peaks. See the example in Figure 63.

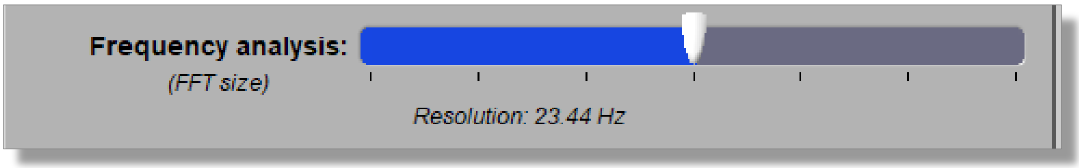


Figure 62 - Field for adjusting the FFT resolution.

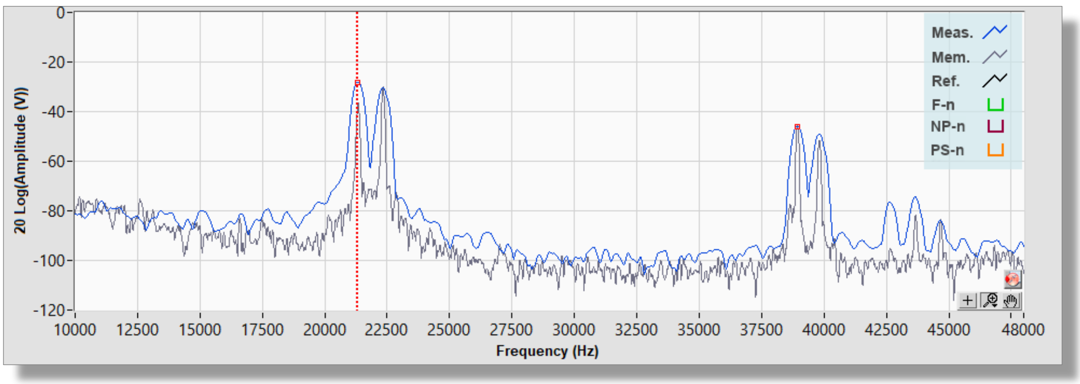


Figure 63 - Spectrum showing the impact of different FFT resolutions, the resolution was 46.87 Hz for the blue curve and 11.72 Hz for the gray one.

The FFT resolution also determines the signal interval processed for obtaining the frequency spectrum. This region is indicated by the vertical red dashed lines in the acquired signal, as shown in Fig. 64 (SPECTRUM sub-tab) and may be moved along the time axis.

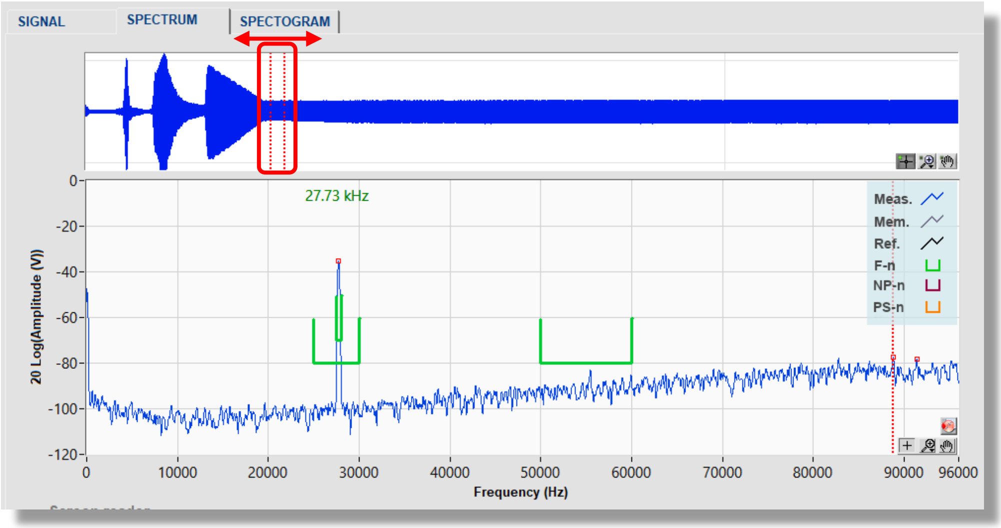


Figure 64 - The signal interval processed for obtaining the frequency spectrum is between the dashed red lines that can be moved over the time axis.

The sample rate, points quantity, FFT size and trigger level adjustment should be carried out by the user in agreement with the characteristics of the test object or specimen under test.

Besides the parameters from the configuration interface shown on Fig. 57, it is also needed to set the "Trigger level" shown in Fig. 65 (SIGNAL sub-tab). It allows adjusting the graph scale and the acquisition triggering level (the horizontal green lines in the graph). This adjustment is also important to optimize the signal visualization.

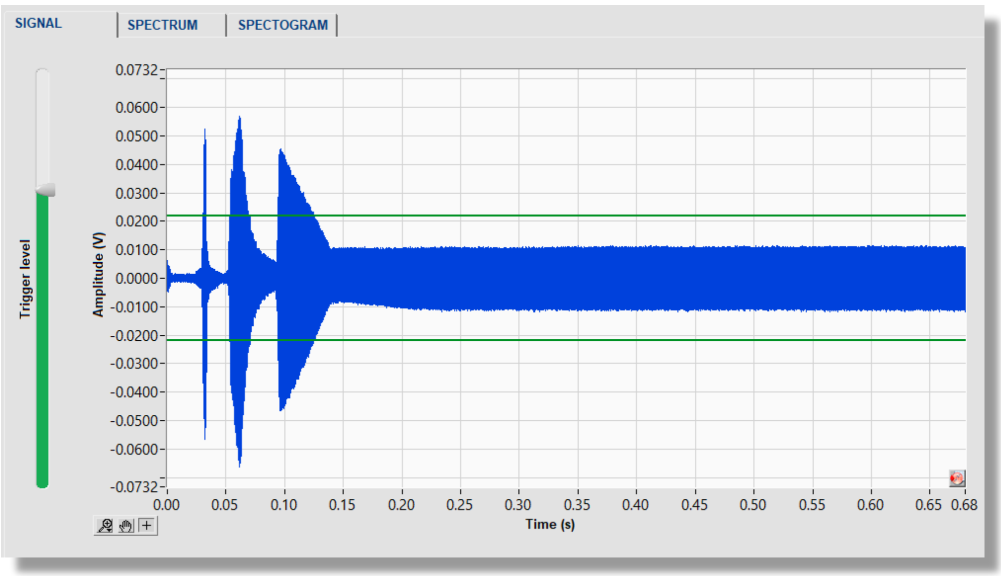


Figure 65 - Signal sub-tab with the trigger level adjustment.

Soneteste® Software may request offset adjustment on the amplitude scale. This adjustment is necessary for the acoustic response to be acquired without a DC level (Fig. 66).

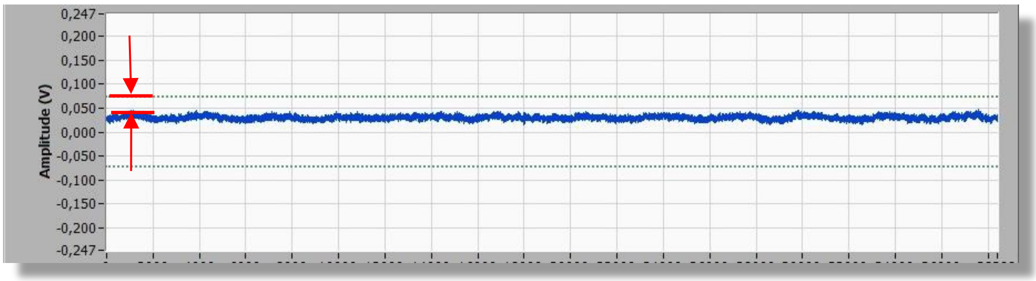


Figure 66 - Graph for the visualization of the signal, indicating an offset of approximately "+0,023 Volt".

If the blue line is on the zero-amplitude line (0,000), it is not necessary to perform the steps described next. Otherwise, follow the instructions after these steps.

Offset adjustment procedure:

Step 01 – Perform a preliminary signal acquisition and verify if the signal average value coincides with the x-axis (y = 0.000). Figure 54 shows an example in which the blue line does not coincide with the x-axis, indicating the need for an offset correction.

Step 02 – Access the configuration interface and fine adjust the offset (Fig. 67).

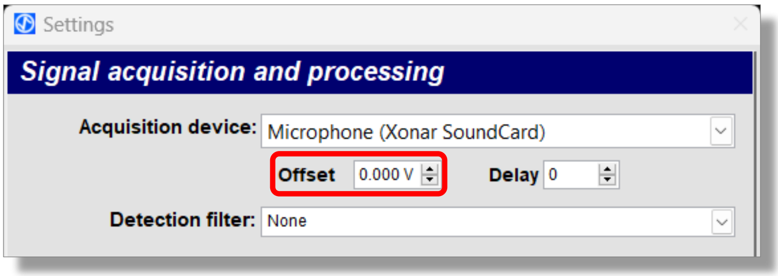


Figure 67 - "Offset" adjustment section.

Step 03 – Perform successive adjustments changing the "*Offset*" and performing signal acquisitions until the average signal coincide with the x-axis (Fig. 68).

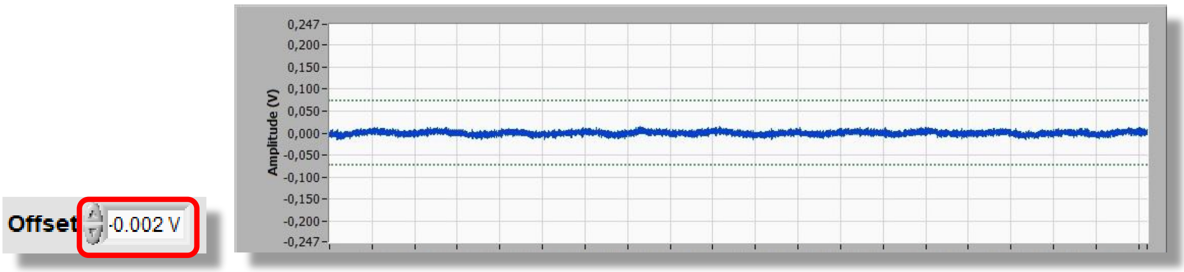


Figure 68 - Detailed image of the "Offset" configuration result.

8.2.3 Setting the IED Automatic Impulse Device

If a IED is connected and the box "Enabled" is ticked, the controls will appear (Fig. 69).

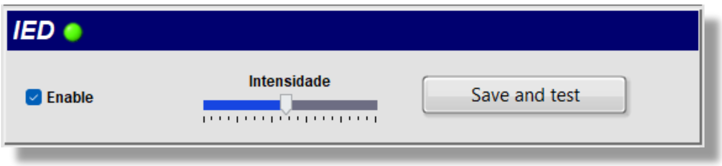


Figure 69 - IED Automatic Impulse Device configuration screen, If it is connected.

This interface allows adjustment of the impulse excitation intensity in "%" by using a the "Intensity" slider. The higher the percentage, the higher the impulse intensity. The "Save and test" button saves the configuration and applies an impulse for the user to observe the changes effect on the impulse excitation intensity.

Note: The impulse intensity should be adjusted by the user according to the test object or specimen material and dimensions, always aiming at a proper excitation without moving or damaging it.

8.2.4 Acquisition auto mode

Soneteste® Software has an acquisition auto mode for supervising ultrasonic welding machines and ultrasonic equipment. When the "Auto" checkbox is marked, automatic acquisition trigger will occur according to the time interval programmed in the "Interval" as show in Fig. 70. To exit auto mode, uncheck the "Auto" checkbox and wait for a final acquisition to be made.

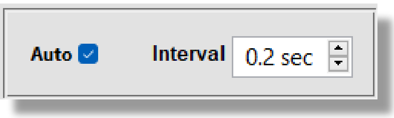


Figure 70 – Auto mode checkbox and parameter "Interval".

Note: The IED Automatic Impulse Device is necessary to employ the automatic acquisition mode for devices except for self-driven systems such as ultrasonic welding machines and ultrasonic cleaners.

The test results are exported to the Results tab automatically after each measurement.

8.3 Acquisition tab

Soneteste® Software is organized in tabs (a) and sub-tabs (b), as shown in Fig. 71, and detailed in Table 3. The Acquisition tab comprises the SIGNAL, SPECTRUM AND SPECTROGRAM sub-tabs, as well as fields and buttons for data entry, criteria parameters, and general judgment indicator (c). The signal interval processed for obtaining the frequency spectrum is indicated by vertical red dashed lines in the smaller graph of the SPECTRUM sub-tab.

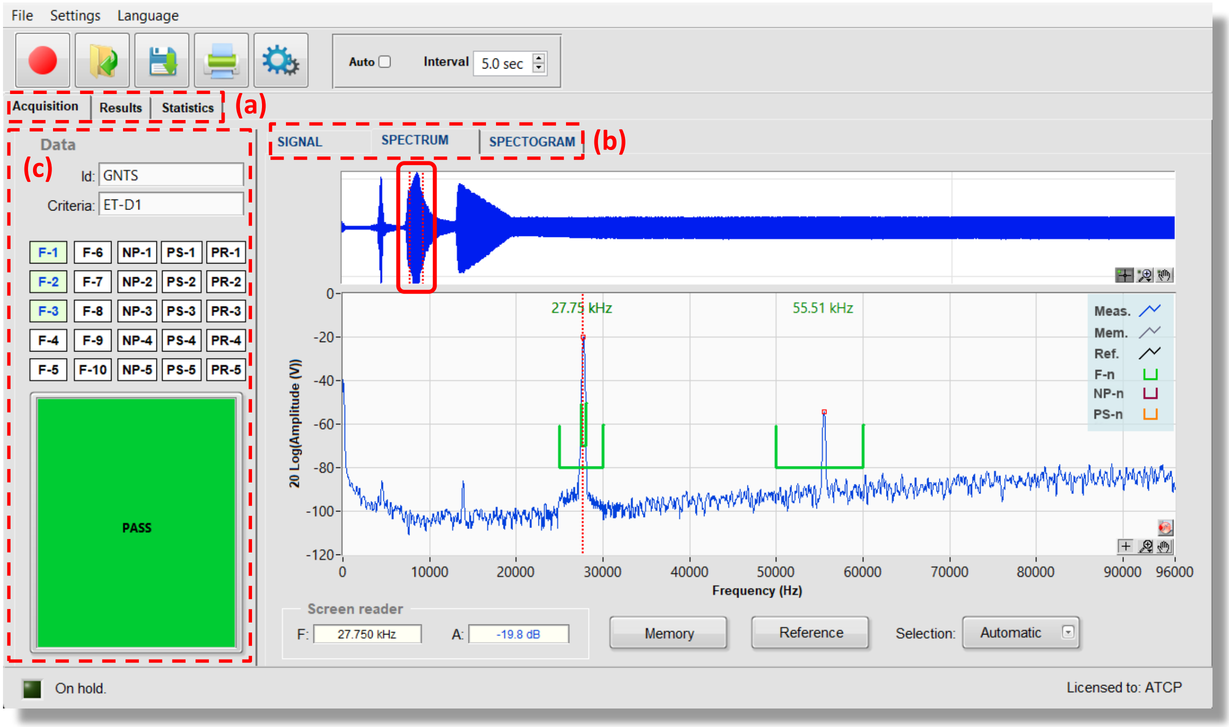


Figure 71 - Soneteste® Software Acquisition tab (a), its sub-tabs (b), and fields and buttons for data entry, criteria parameters, and general judgment indicator (c).

Table 3 – Soneteste® Software tabs and sub-tabs.

Tab for signal acquisition:	Acquisition
Sub-tab for signal visualization in the time domain:	SIGNAL
Sub-tab for spectrum visualization in the frequency domain:	SPECTRUM
Sub-tab for spectrogram visualization:	SPECTOGRAM
Tab for storing the results:	Results
Tab for present the statistics:	Statistics

8.3.1 Data entering, criteria buttons and general judgment indicator

The region on the left side of the Acquisition tab, as depicted in (Fig. 71-c), encompasses the fields for data entry, criteria buttons, and the general judgment indicator, as illustrated in Fig. 72.

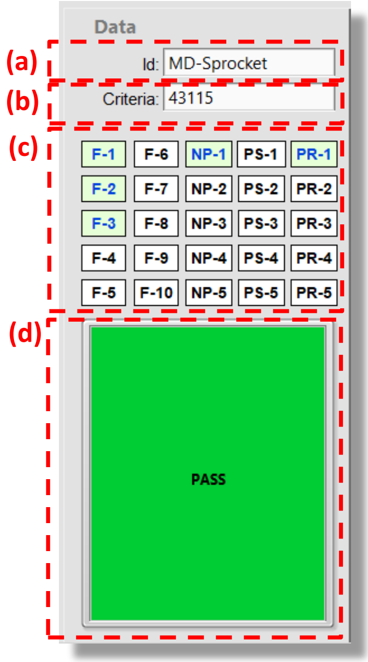


Figure 72 - Fields for the specimen or test object identification (a), criteria name (b), criteria buttons (d), and result indicator.

Explanation of the elements depicted in Fig. 72:

(a) "Id": Specimen or test object identification.
(b) "Criteria": Name of judgment criteria.
(c) "F": Buttons to access the parameters of the criteria based on frequency.
  "NP": Buttons to access the parameters of the criteria based on the number of peaks.
  "PS": Buttons to access the parameters of the criteria based on peaks spacing.
  "PR": Buttons to access the parameters of the criteria based on peaks' frequency ratio.
(d) Indicator: Presents the general judgment result (Fail/Pass).

The acceptance criteria should be configured according to the application. There are 25 options: 10 for frequency, 5 for the number of peaks inside an interval, 5 for peak spacing, and 5 for peaks frequency ratio (Fig. 72-c). The color of the criteria buttons changes in agreement with the individual judgments (text in blue for "Pass" and in red for "Fail").

Figure 73 illustrates an example of parameters for configuring the frequency criteria (F criteria). It is possible to turn it on and off, adjust the minimum and maximum acceptable frequency, adjust the minimum amplitude for detection, and set the selection conditions.

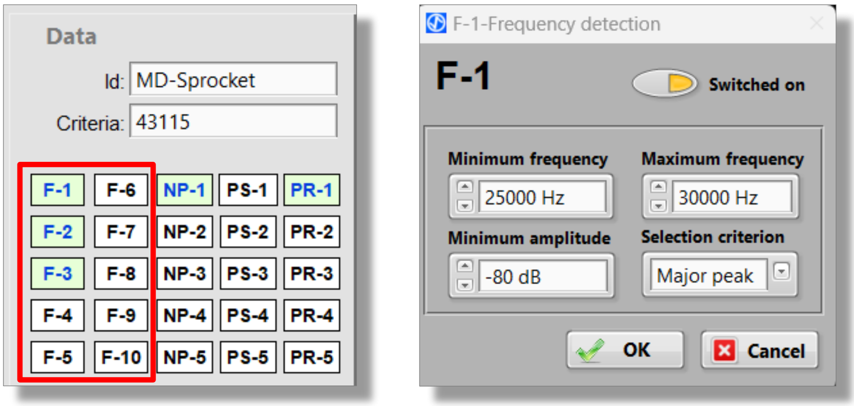


Figure 73 - Configuration parameters for the frequencies criteria (F).

The frequency criteria pass if the detected frequency falls within the specified frequency interval and exceeds the minimum amplitude requirement. A label reporting the detected frequency will appear inside the SPECTRUM tab, as depicted in Fig. 74.

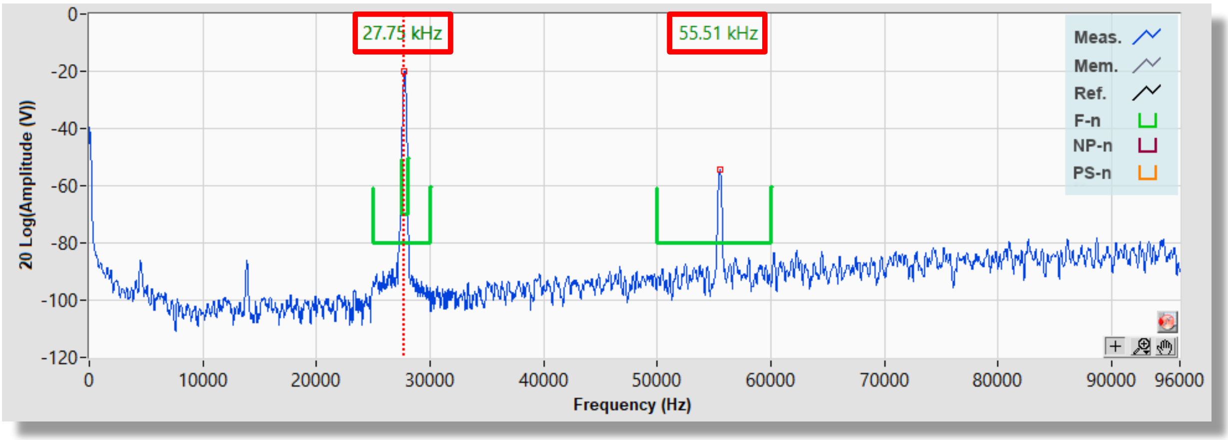


Figure 74 - Frequencies detected with labels generated by two F criteria.

Figure 75 illustrates an example of configuration parameters for the number of peaks inside a frequency interval (NP criteria). This criterion can be enabled or disabled, and the minimum and maximum frequencies for the interval can be adjusted along with the minimum amplitude for detection and the expected number of peaks. The NP criteria pass if the exact number of expected peaks is detected.

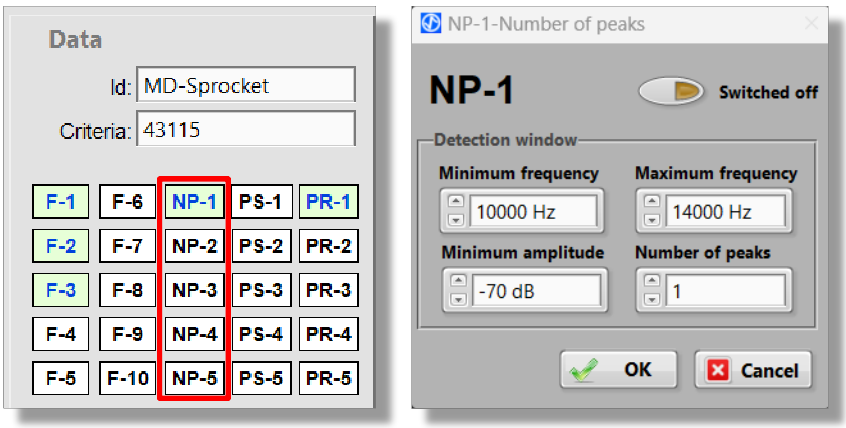


Figure 75 - Configuration parameters for the number of peaks criteria (NP).

Figure 76 displays the configuration parameters for peak spacing inside a frequency interval (PS criteria). This criterion can be enabled or disabled, and the minimum and maximum frequencies for the interval can be adjusted, along with the minimum amplitude for detection and the selection criterion. The PS criteria pass if the spacing between the found frequencies falls within the judgment range. The criterion calculation involves multiplying 100 by the spacing between peak frequencies and dividing it by the average of the two peak frequencies.

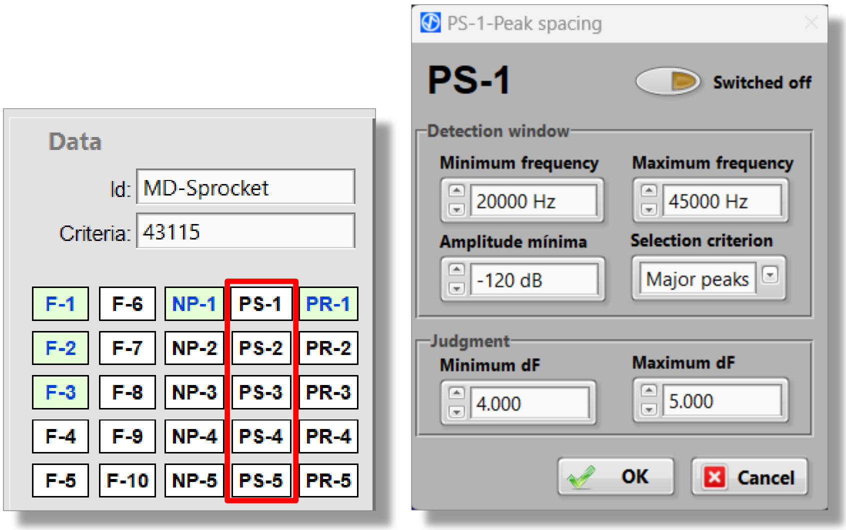


Figure 76 - Configuration parameters for peaks spacing criteria (PS).

Figure 77 illustrates the configuration parameters for peak frequency ratio (PR). This criterion can be enabled or disabled, and frequencies can be selected (from F-1 to F-10). Additionally, the minimum and maximum acceptable ratio can be adjusted. The PR criterion passes if the found ratio is within the judgment range.

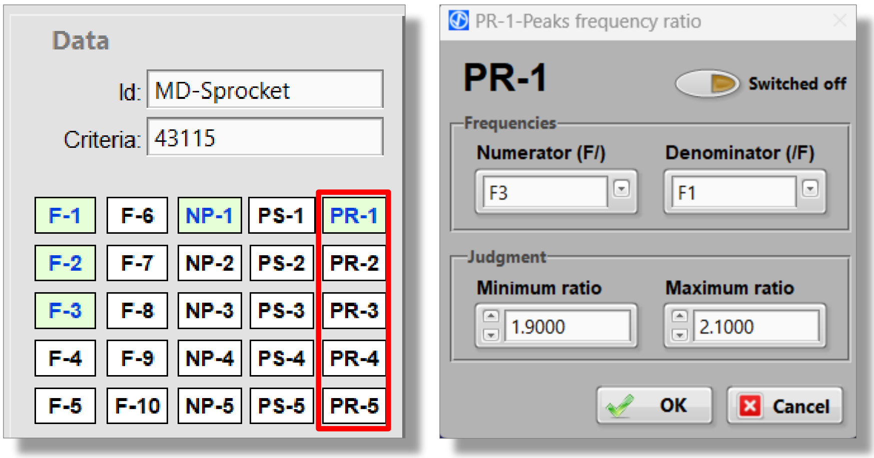


Figure 77 – Configuration parameters for peaks ratio criteria.

8.3.2 SIGNAL sub-tab

The SIGNAL sub-tab, highlighted in Fig. 78, displays the signal acquired in the time domain. Its main control is the "Trigger level" slider located at the left, which adjust both the graph scale and the trigger level simultaneously. The trigger level is indicated by the horizontal green lines and is approximately equal to the 30% of the maximum amplitude.

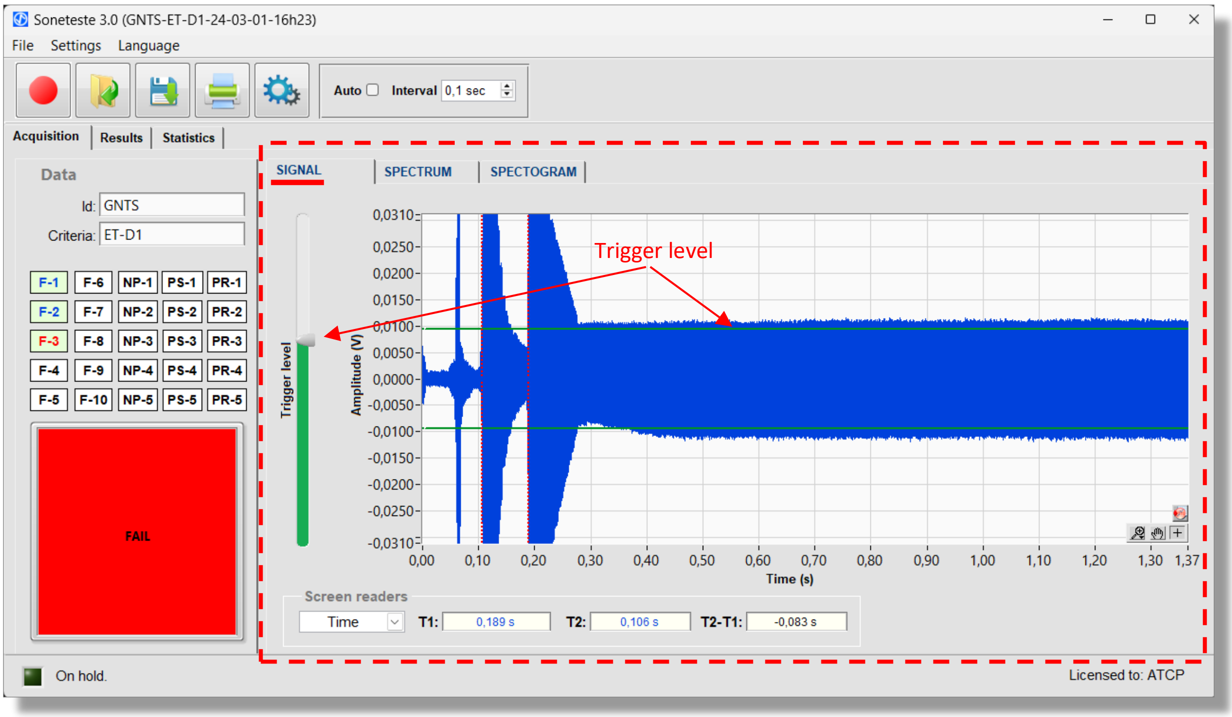


Figure 78 - SIGNAL sub-tab.

The icon  located in the bottom right corner of the graph allows users to export the chart data to a CSV file, enabling further analysis with other software tools.

The graph visualization can be adjusted using the tools of the cluster , on the left side, as detailed below. Note: These tools are presented in all graphs.

The tool  encompasses the following options, as shown in Fig. 79.

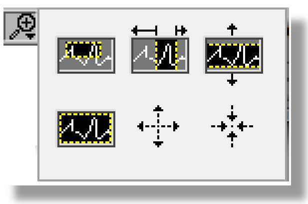
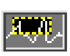
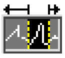
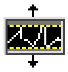


Figure 79 – Tool options to zoom the graph.

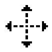
From the left to the right, the top to the bottom:

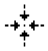
 Zoom in the selected area.

 Horizontal zoom into the selected area.

 Vertical zoom into the selected area.

 Automatically adjusts the spectrum to fit the screen.

 Gradually increases the zoom when the user clicks on the graph or holds down the left mouse button.

 Gradually decreases the zoom when the user clicks on the graph or holds down the left mouse button.

The  button allows the user to move the spectrum across the screen. By keeping the left mouse button clicked, users can adjust the spectrum as desired.

8.3.3 SPECTRUM sub-tab

In the SPECTRUM sub-tab, shown in Fig. 80, users can visualize both the signal (smaller graph) and the corresponding spectrum obtained from processing the signal (larger graph). The detected frequencies are displayed on labels in green, associated with Fs' criteria. The vertical red dashed line on the larger graph server as a screen reader. The vertical lines on the smaller graph determine the interval processed for obtaining the frequency spectrum and can be moved. To move any vertical or horizontal dashed line, use the tool .

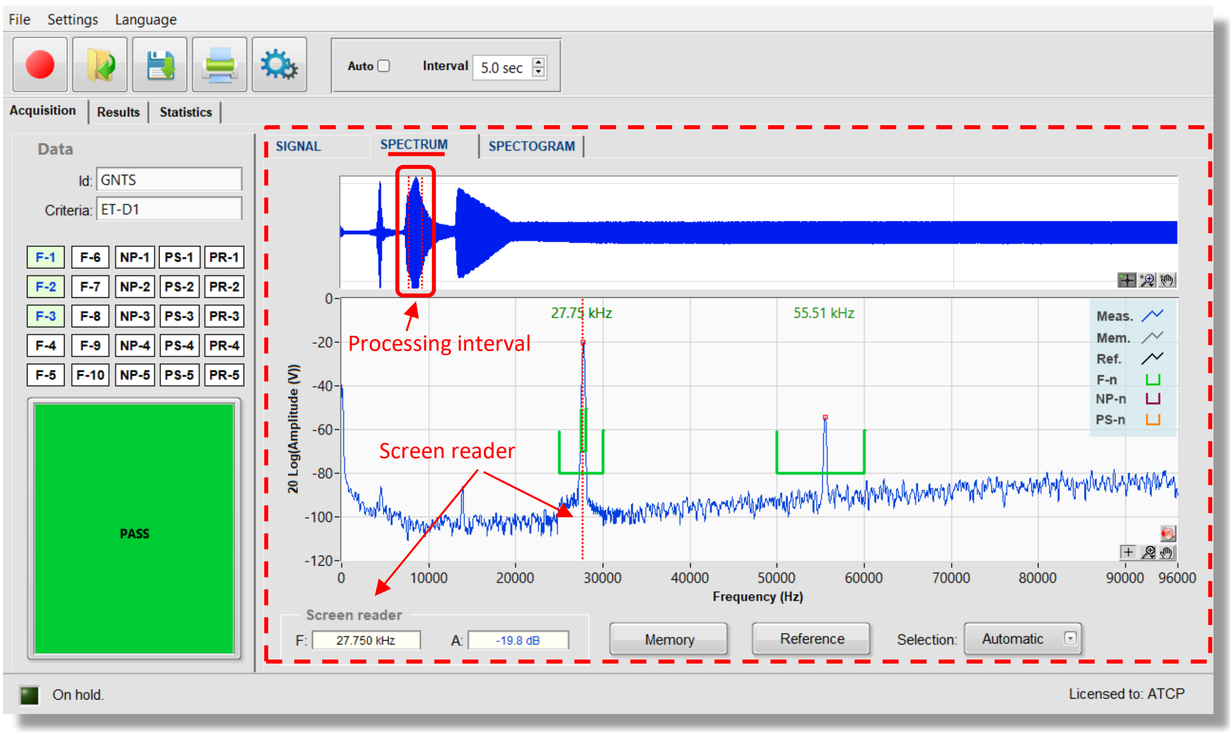


Figure 80 - SPECTRUM sub-tab, screen reader, and control for peaks selection.

At the "Selection" control (Fig. 81), users can choose the method to detect the peaks: "By baseline", in which all peaks above a specific amplitude indicated by the horizontal red line are selected; or "Automatic", where an algorithm automatically detects the most relevant peaks. To adjust the minimum amplitude, users can drag the horizontal red dashed line with the tool to the required level, as shown in Fig. 82 (make sure the option "Base Line" is enabled under "Selection").

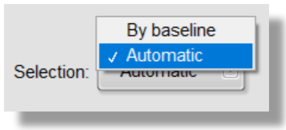


Figure 81 - Section for choosing the peak selection method: "Base Line" or "Automatic".

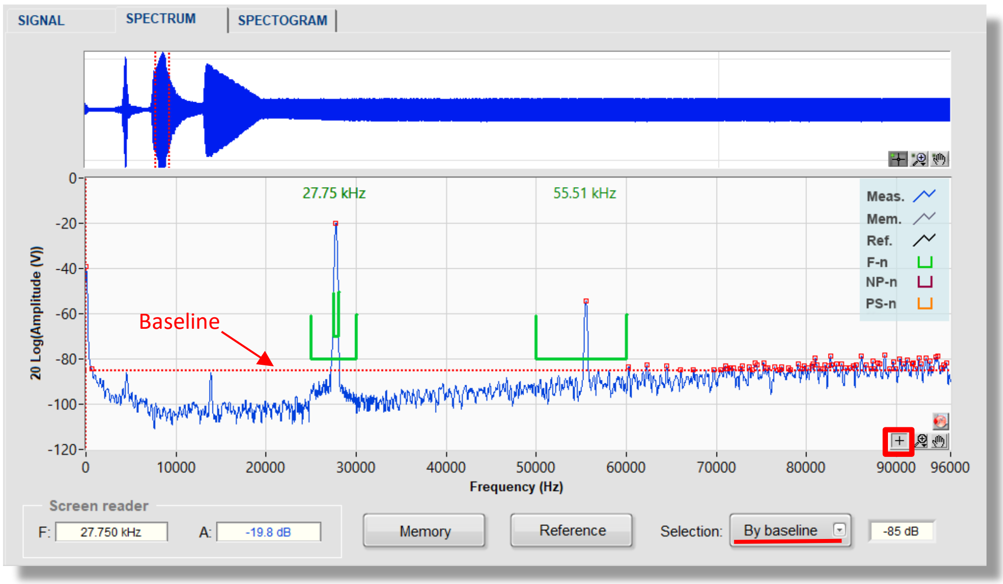


Figure 82 - Peaks detection "By baseline".

The "Memory" button allows user to display the last two curves in gray on the graph, as show in Fig. 83.

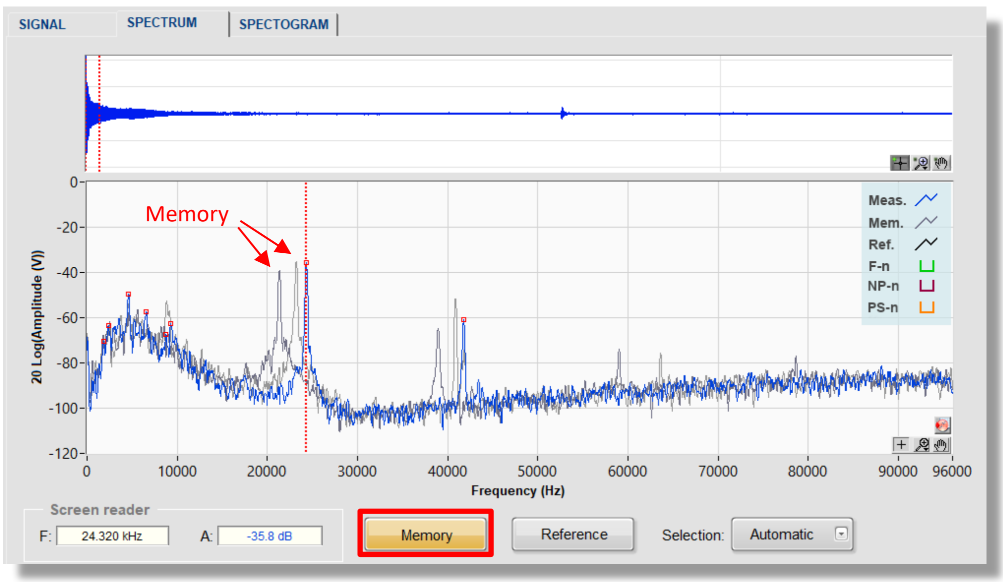


Figure 83 - Memory function for displaying the last two measurements on a gray scale.

The “Reference” button allows users to freeze a reference curve on the graph, as show in Fig. 84.

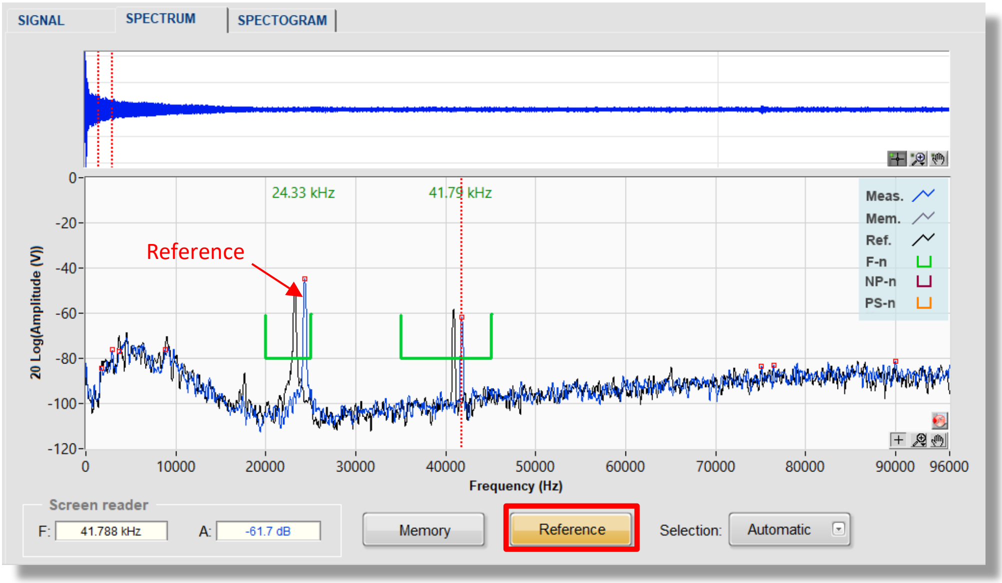


Figure 84 - Reference function to freeze a reference measurement in graph (in red).

The “Memory” and “Reference” buttons/functions can be activated simultaneously.

8.3.4 SPECTROGRAM sub-tab

The SPECTROGRAM sub-tab (Fig. 85) displays the signal spectrogram, which is a graph of frequency x time x amplitude in a color scale. It is possible to adjust the color scale by using the couple of sliders on the right side or by checking the 'Auto' box."

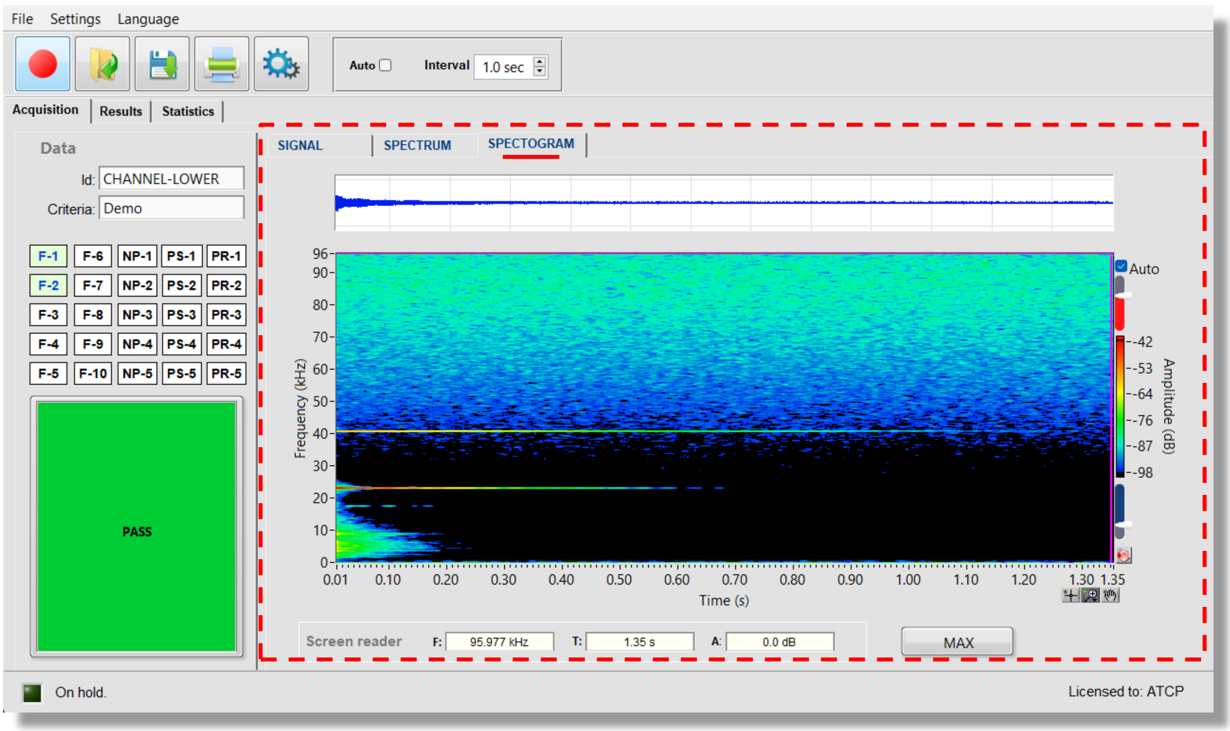


Figure 85 - SPECTOGRAM sub-tab, screen reader, and color scale controls.

8.4 Results tab

This tab contains a table for the output results, as shown in Fig. 86.

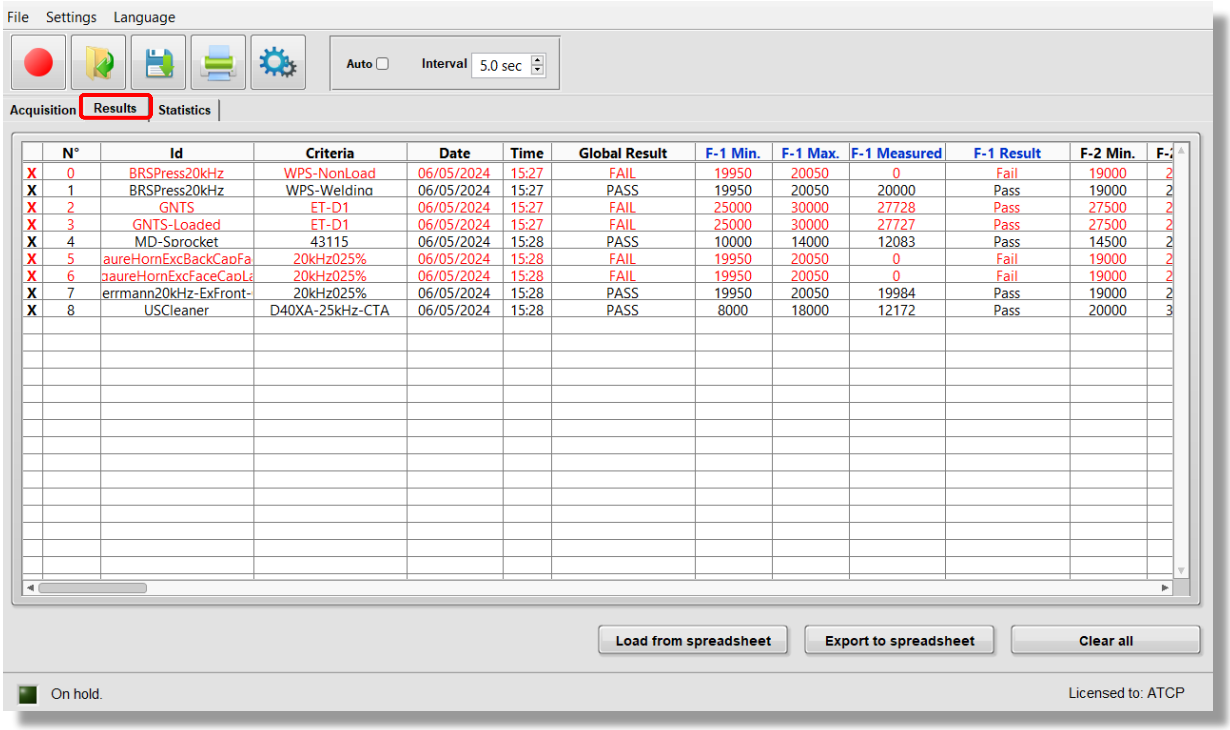


Figure 86 - Soneteste® Software Results tab.

This table contents may be exported ("Export to spreadsheet" button) and loaded ("Load from spreadsheet" button) to/from a spreadsheet file in csv format.

8.5 Statistics tab

The Statistics tab, partially shown in Fig. 87, presents statistical information about the results. This data is useful for refining the judgment criteria in quality control and resonant ultrasonic spectroscopy applications.

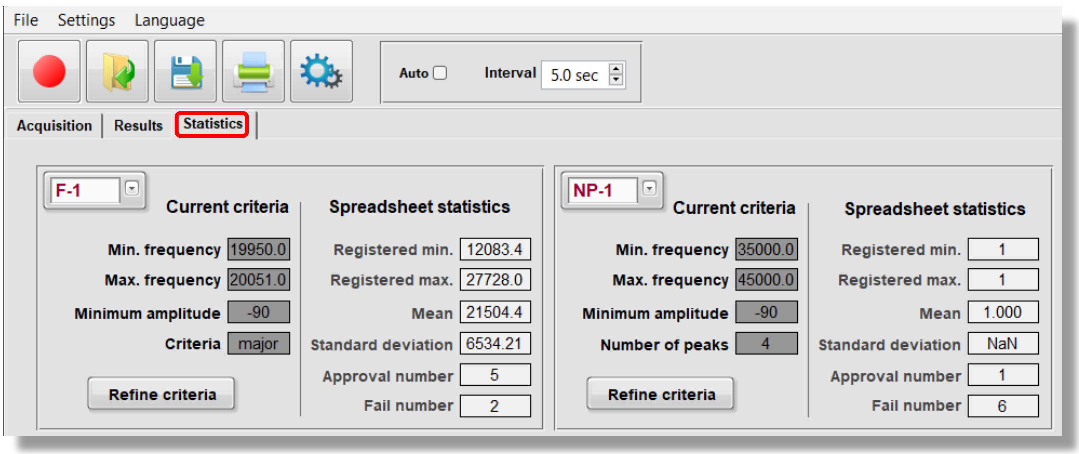


Figure 87 - Soneteste® Software Statistics tab.

The "Refine criteria" buttons within each main data block of the Statistic tab allows users to visualize the results graphically and make fine adjustments to the criteria. An example of this is shown in Fig. 88 for frequency criteria.

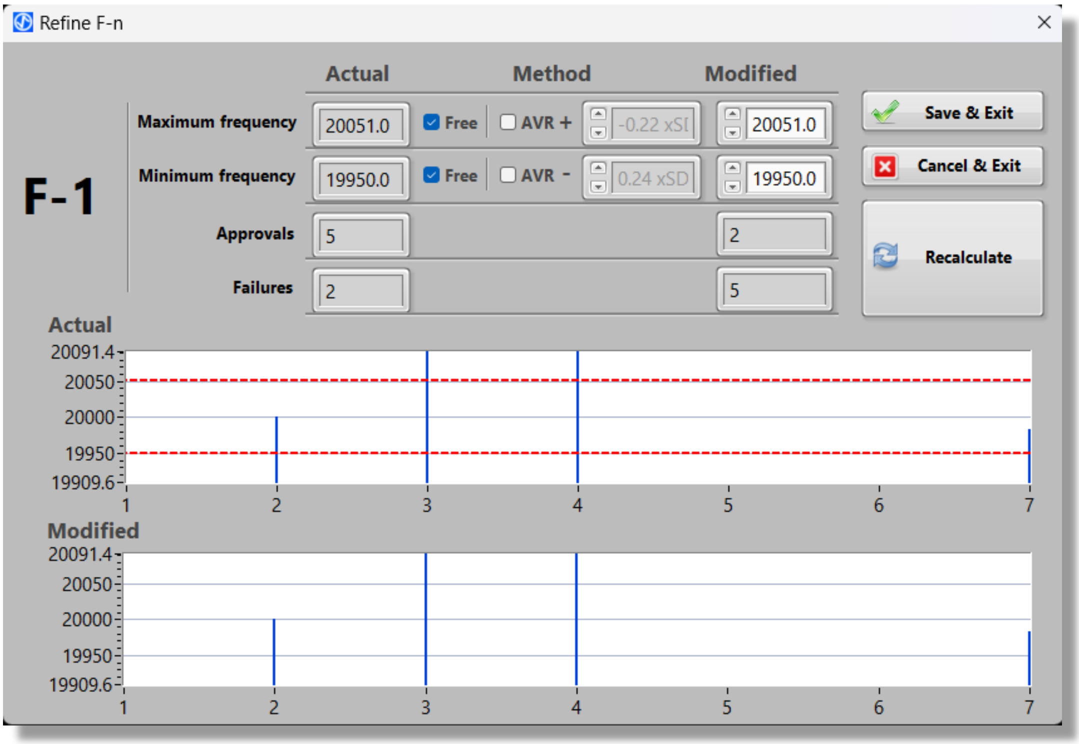


Figure 88 - Soneteste® Software Statistics tab criteria refining interface for frequency criteria. Each number in the graphs is one of the results.

The criteria refinement can be done by freely changing the values (using the checkbox 'Free') or by using the average and standard deviation (using the checkbox 'AVR ±').

8.6 Header and footer

In the top left corner of the software's main interface, there is a display, as shown in Fig. 89, which indicates the software version and the name of the last loaded or saved file (within parentheses).

Figure 89 - Example of informatio on the Soneteste Software header.

In the footer, located in the bottom left corner, there is a status display, as shown in Fig. 90. When the software is in waiting mode, the message displayed will be 'On hold.' Other possible messages include 'Acquiring data', 'Changing language', 'Importing data", and 'Exporting data'.

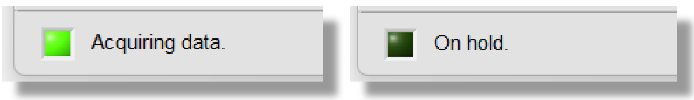


Figure 90 - Example of informatio on the Soneteste® Software footer let side.

While the software waits for the acquisition or is process information, the square indicator will be on in light green, as shown on the right image in Fig. 91, indicating that the operator must wait.

In the bottom right corner of the software footer, there is information about who the software license belongs to, as shown in Figure 91.

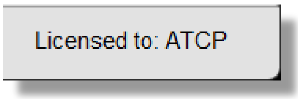


Figure 91 - Example of information on the Soneteste® Software licencing on the footer right side.

8.7 Closing the software

To exit the Soneteste® Software, click on "Exit", on the top-right corner of the main interface, or choose "Exit" from the "File" menu.

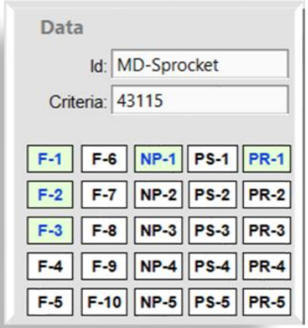
It is highly recommended to exit the Soneteste® Software by one of the methods described above to ensure that the last settings are saved and recalled upon the next opening.

9. Quick guide for measurements

1

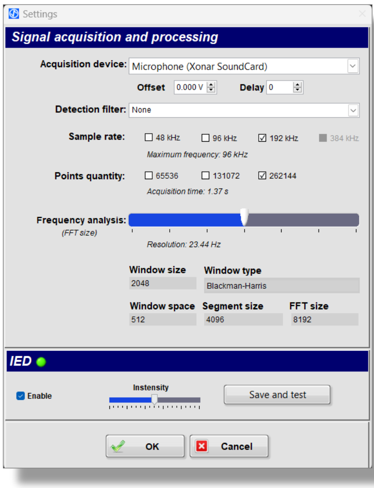
Run Soneteste® Software.

2



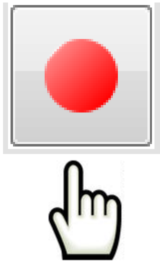
Load a file with the criteria or adjust / create it.

3



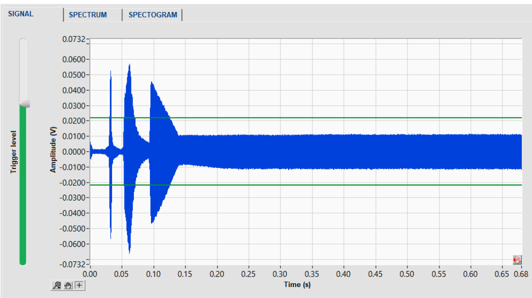
Set the signal acquisition and processing parameters, if necessary.

4



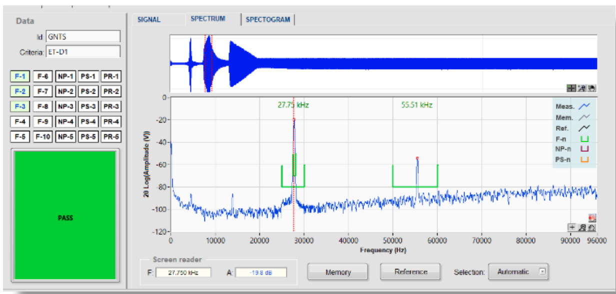
Perform the signal acquisition by clicking on the recording button or press F1.

5



Refine the trigger level and repeat the acquisition if necessary.

6



Verify the spectrum and judgment result.

7

For further information, visit:

www.atcp-ndt.com

10. Troubleshooting

Problem	Possible cause	Solution
Software does not initialize.	Incorrect installation of the software.	Ensure that all the steps described in item 6 of this manual have been followed correctly. For multi-user computers, run the software in Windows 7 compatibility mode.
Software does not recognize the IED Automatic Impulse Device or the acquisition USB module ADAC connected to the system.	The IED or ADAC was connected after the software was initiated.	Remove the IED or the ADAC from the input jack, connect it again and then restart the software.
After the signal acquisition, the software takes too long to show the results.	The acquisition time is too high.	Lower the "Acquisition time" by clicking in the Settings button.
	The software was not ready to start the measurement.	Click on "Recording button" again.
No signal was detected by the software.	The Trigger level is incorrect.	Adjust the Trigger level so the specimen acoustic response can trigger the acquisition.
No frequency peak is detected or there is no triggering.	The settings are incorrect.	Verify the selection criteria described in the item 8.3.3 of this manual.
The measurement results are not consistent with the material characterized or are not being calculated.	The specimen is not correctly positioned to perform the measurements.	Position the specimen correctly as described on the installation and operation manual of the specimen used.
	Inadequate support for the specimen type.	Use adequate specimen support.
The spectrum maximum frequency is too low.	The sample rate is incorrect.	Increase the sample rate and/or change the signal acquisition device.

11. Warnings

⚠ It is indispensable to read all the information in this installation and operation manual to ensure the correct use of Soneteste® Software.
⚠ The power outlet where the computer will be connected must have a functional ground pin.
⚠ The non-compliance with the instructions provided by this manual may reduce or invalidate the warranty.

12. Technical support

If the equipment does not run properly, verify if the problem is not related to any of the issues listed in item 10. Troubleshooting. Users should contact ATCP Physical Engineering if they are unable to resolve the issue after troubleshooting emailing info@atcp-ndt.com.

13. Warranty

ATCP Physical Engineering offers a 2-year warranty for the software and equipment starting from the date of purchase. Factors that may cause the loss of warranty:

- The non-compliance with the recommended software installation and operation procedures.
- Incorrect installation or any other damage caused by incorrect use.
- Violation or modification by non-authorized agent.

After the warranty expiration date, all services and expenses shall be charged as per the company's policy.

14. Statement of responsibility

ATCP Physical Engineering takes total technical and legal responsibility over Soneteste® Software and guarantees that all information provided herein are true.

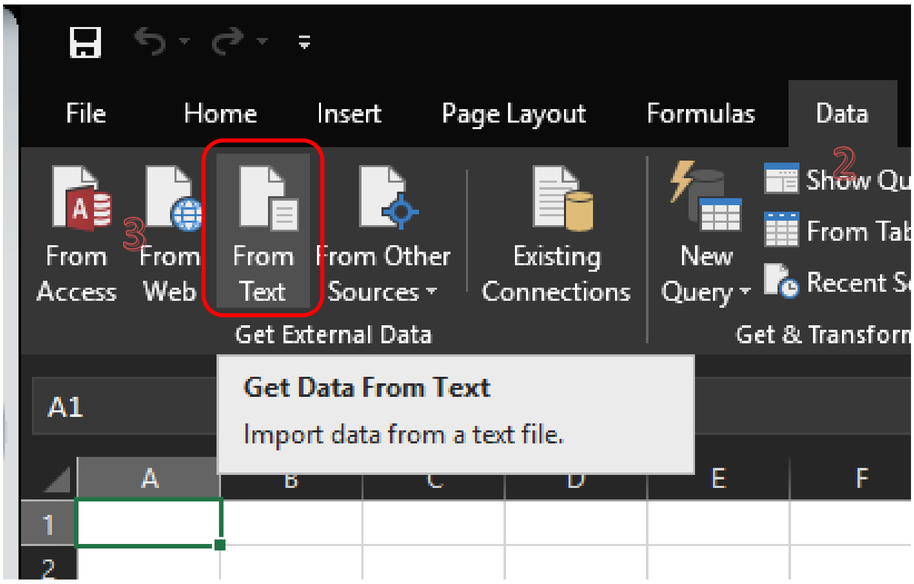
Appendix – CSV file Import in Microsoft Excel

You can import data from a text file into an existing spreadsheet.

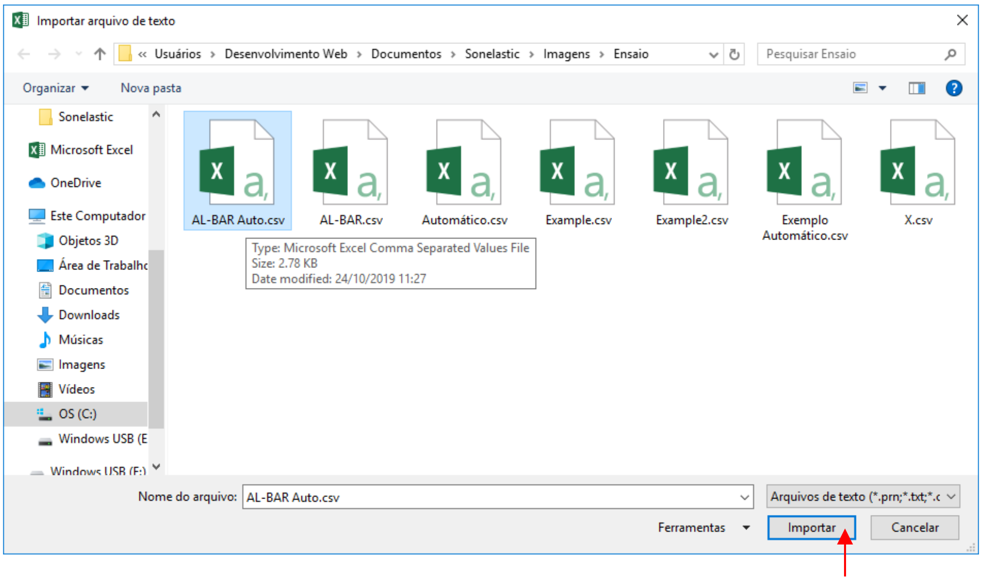
1. Click in the cell where you want to place the text file data.

2. Click on "Data".

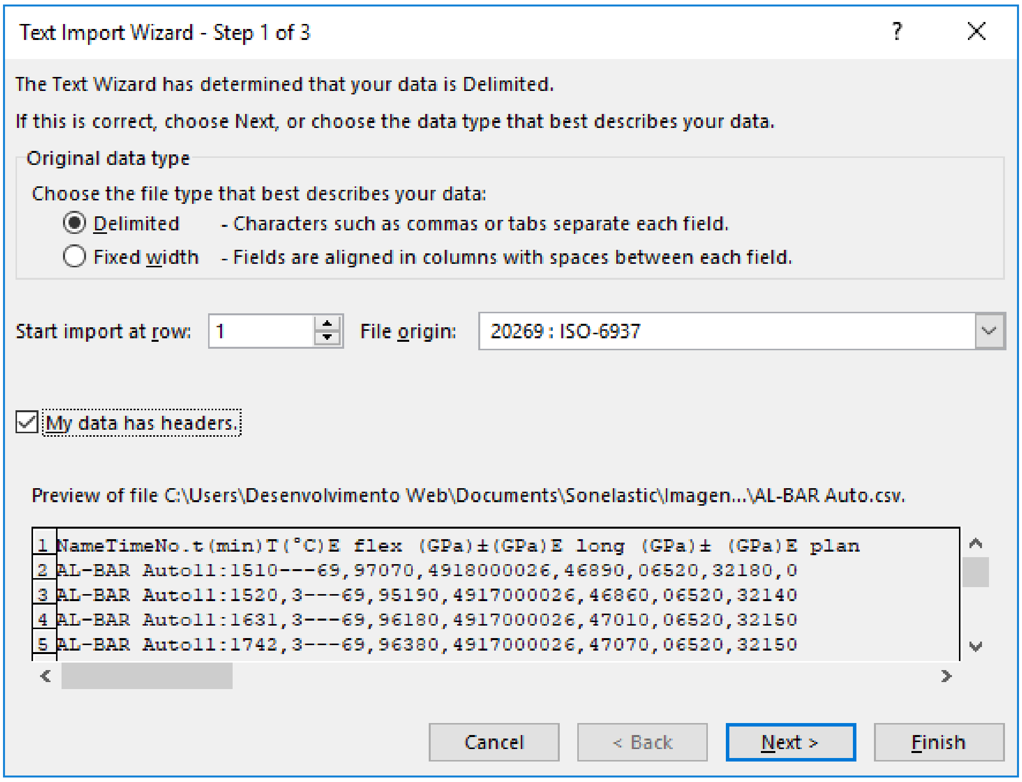
3. In the "Get External Data" group, click "From Text".

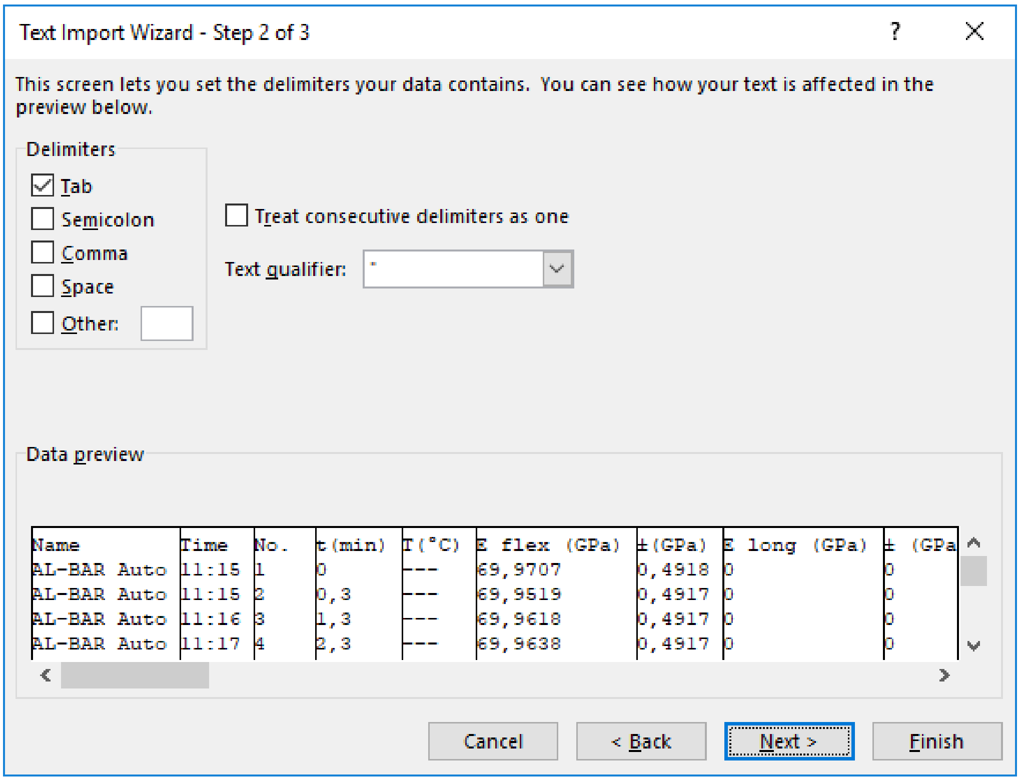


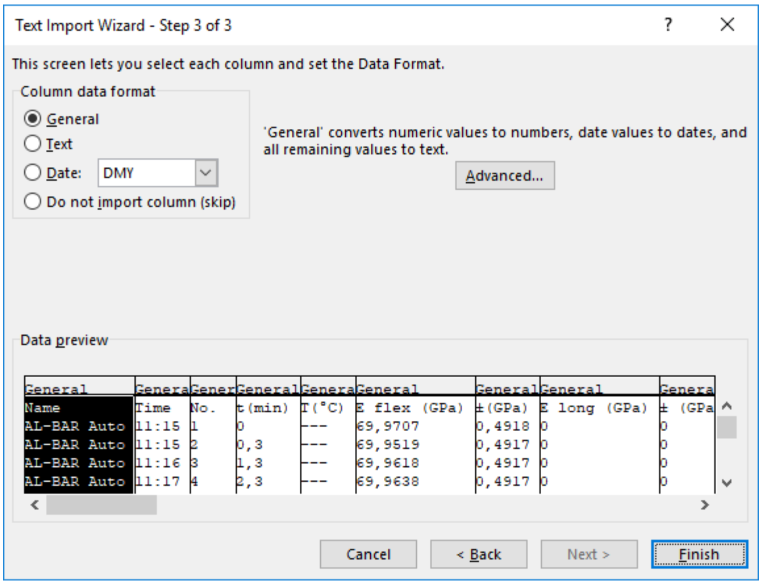
4. In the import data dialog box, locate and double-click the text file you want to import and click import.



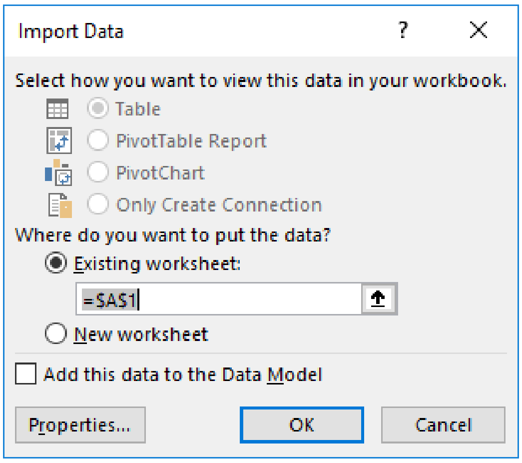
5. In the Import Wizard, configure according to the following images and click next.



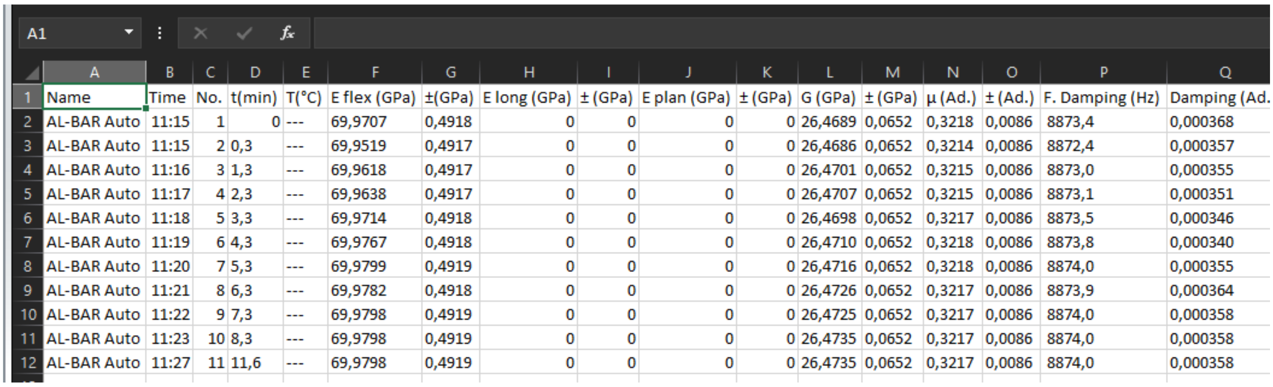




6. Click finish. At the "Import Data" screen, click OK.



7. Review the imported data in Excel to ensure accuracy and formatting.



Name	Time	No.	t(min)	T(°C)	E flex (GPa)	±(GPa)	E long (GPa)	± (GPa)	E plan (GPa)	± (GPa)	G (GPa)	± (GPa)	µ (Ad.)	± (Ad.)	F. Damping (Hz)	Damping (Ad.
AL-BAR Auto	11:15	1	0	---	69,9707	0,4918	0	0	0	0	26,4689	0,0652	0,3218	0,0086	8873,4	0,000368
AL-BAR Auto	11:15	2	0,3	---	69,9519	0,4917	0	0	0	0	26,4686	0,0652	0,3214	0,0086	8872,4	0,000357
AL-BAR Auto	11:16	3	1,3	---	69,9618	0,4917	0	0	0	0	26,4701	0,0652	0,3215	0,0086	8873,0	0,000355
AL-BAR Auto	11:17	4	2,3	---	69,9638	0,4917	0	0	0	0	26,4707	0,0652	0,3215	0,0086	8873,1	0,000351
AL-BAR Auto	11:18	5	3,3	---	69,9714	0,4918	0	0	0	0	26,4698	0,0652	0,3217	0,0086	8873,5	0,000346
AL-BAR Auto	11:19	6	4,3	---	69,9767	0,4918	0	0	0	0	26,4710	0,0652	0,3218	0,0086	8873,8	0,000340
AL-BAR Auto	11:20	7	5,3	---	69,9799	0,4919	0	0	0	0	26,4716	0,0652	0,3218	0,0086	8874,0	0,000355
AL-BAR Auto	11:21	8	6,3	---	69,9782	0,4918	0	0	0	0	26,4726	0,0652	0,3217	0,0086	8873,9	0,000364
AL-BAR Auto	11:22	9	7,3	---	69,9798	0,4919	0	0	0	0	26,4725	0,0652	0,3217	0,0086	8874,0	0,000358
AL-BAR Auto	11:23	10	8,3	---	69,9798	0,4919	0	0	0	0	26,4735	0,0652	0,3217	0,0086	8874,0	0,000358
AL-BAR Auto	11:27	11	11,6	---	69,9798	0,4919	0	0	0	0	26,4735	0,0652	0,3217	0,0086	8874,0	0,000358

Notes:

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