GUTERMANN

AQUASCAN 620L

Operating Manual

JW V1.2 Date November 2016

Contents

1. Indications for Use

It is essential to read the operating instructions carefully and completely before using the first time the equipment and software. They contain important information on safety, installation and use. Keep these instructions in a safe place.

1.1. Symbols

	**Warning of dangerous situations that can cause injury and damage to the devices.**
	**Warning** **The AQUASCAN Correlating Sensors contains a very powerful magnet. The operation of cardiac pacemakers and implanted defibrillators can be influenced. People with cardiac pacemakers and implanted defibrillators are not permitted anywhere near this product.**
	**Important notes and tips are a sign Info provided. Follow these guidelines.**
	**Never put in your household waste bin.**

1.2. Safety

The operating and maintenance personnel must read the instructions carefully before using the equipment. Knowing all the information contained therein - in particular the warning and safety instructions - is needed to safely operate the equipment, and to protect yourself and others against possible dangers. Ignoring the warning, safety and operating instructions can result in injury, damage, or a considerable shortening of the equipment life time. Do not make any changes or alterations to our products. Never open the device, otherwise any warranty and conformity expires. For questions concerning replacing the battery, please contact your Gutermann distributor. When using the software or the equipment, make sure you adhere to any applicable regulations, in particular traffic regulations.

1.3. Warning

The Aquascan 620L Correlator contains a very powerful magnet. The operation of cardiac pacemakers and implanted defibrillators can be influenced. People with cardiac pacemakers and implanted defibrillators are not permitted anywhere near this product.

1.4. Intended Use

Aquascan products, hardware, software, and accessories are exclusively intended for industrial use and exclusively intended for leak detection on water pipes of the public water supply. In particular, these products are not intended to be used on waste water and gas pipes. Gutermann Technology GmbH is not liable for any damages caused by misuse, improper operation, and as a result of non-compliance with safety instructions and warnings.

1.5. System Components

The AQUASCAN 620L consists of:

- Windows operated Tablet,

- CommLink unit
- Two radio-operated sensors,
- Battery chargers AC mains and DC,

- Antennae & Cables,

- Hydrophone sensors & Cables,
- AQUASCAN 620L software.

1.6. Charging all equipment

The Sensors and Commlink contain rechargeable batteries and can be charged either from AC mains electricity (110 -240v) using the charger supplied or from the 12v DC socket in a car. All 3 components maybe charged at the same time from the red lead supplied. Remove the red cap from the 12v Cigar plug on the red lead and insert it into either the AC mains charger socket for charging in the office or directly into the 12v socket in the car. An hour is usually enough time to achieve full charge. All units LED will flash during charging and then will turn off when complete.

2. Quick Start Guide

To start, connect antenna to Commlink and switch on.

Figure 1 Switch on the Commlink

The LED will start flashing, indicating initialization state. As soon as flashing stops, the Link unit will be ready for connection by Bluetooth of the Windows operated Tablet. To Pair the Commlink with the Tablet switch on the BlueTooth and tap the BT symbol on the tablet.

Figure 2 Tap the Bluetooth Symbol

The Bluetooth Manager opens then tap New Connection

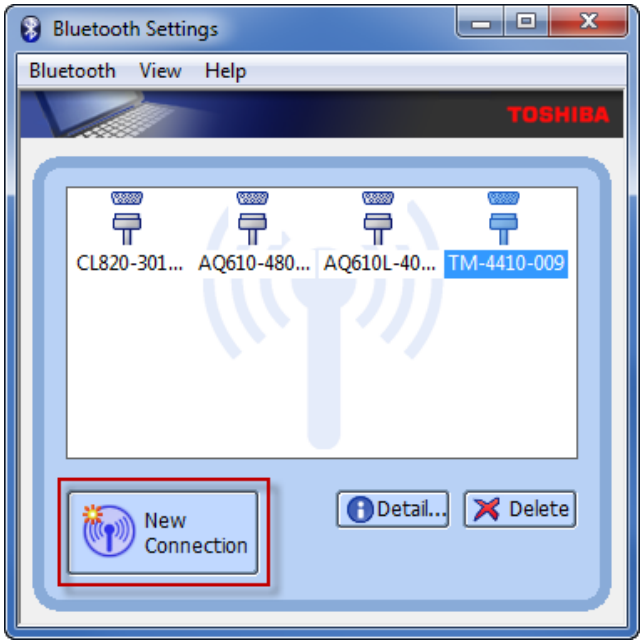


Figure 3 New Connection

Use Express mode and tap next

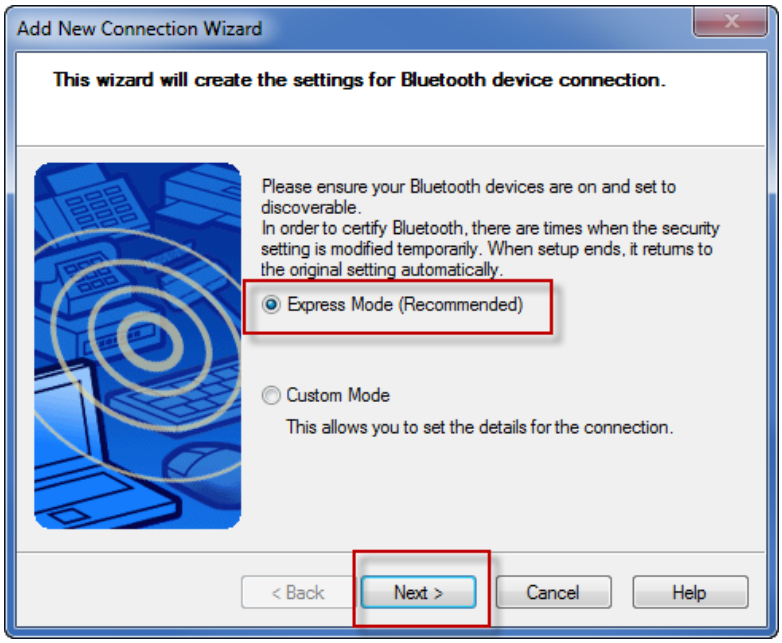


Figure 4 Express Mode

The Commlink serial number appears in the window, highlight it and then Next.

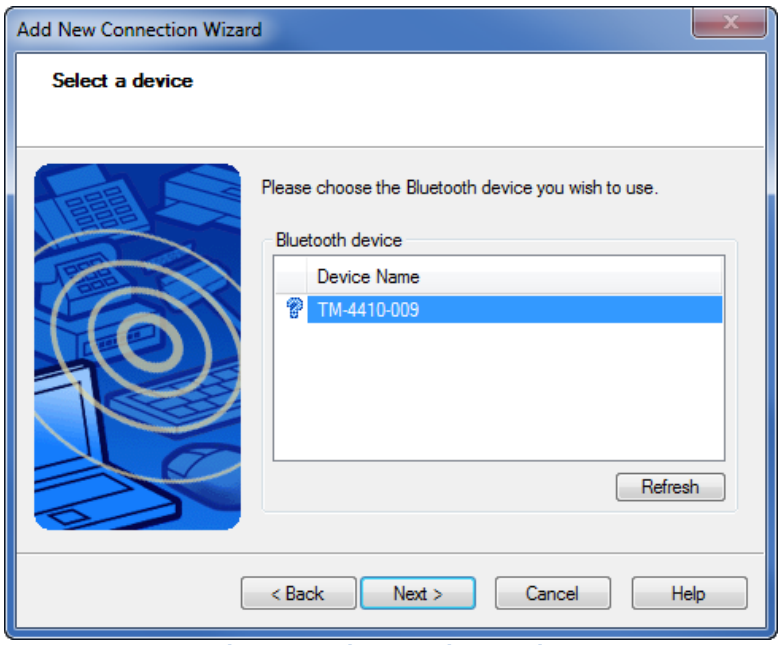


Figure 5 Choose the Device

In the following window enter 4 x Zero (0000).

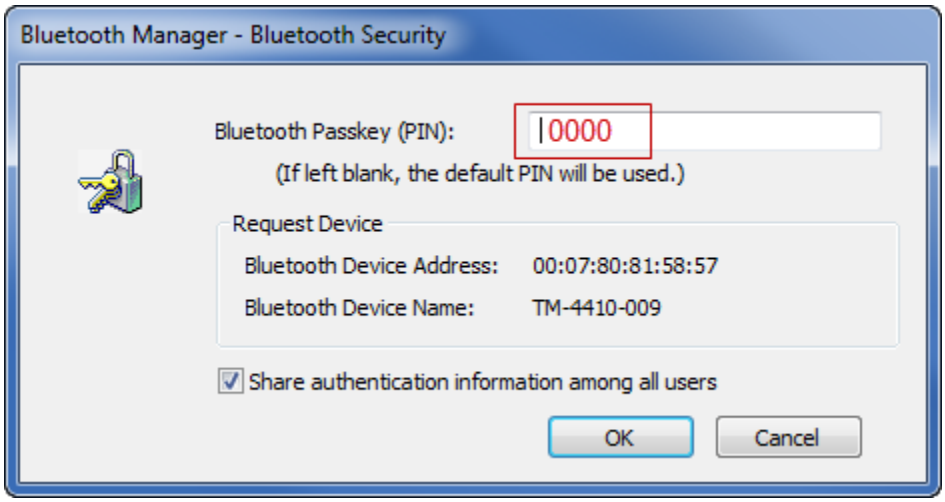


Figure 6 Bluetooth Pin code

The final window will confirm the setup is complete and identify the Com Port (40 in the example below). Take note of the Port number.

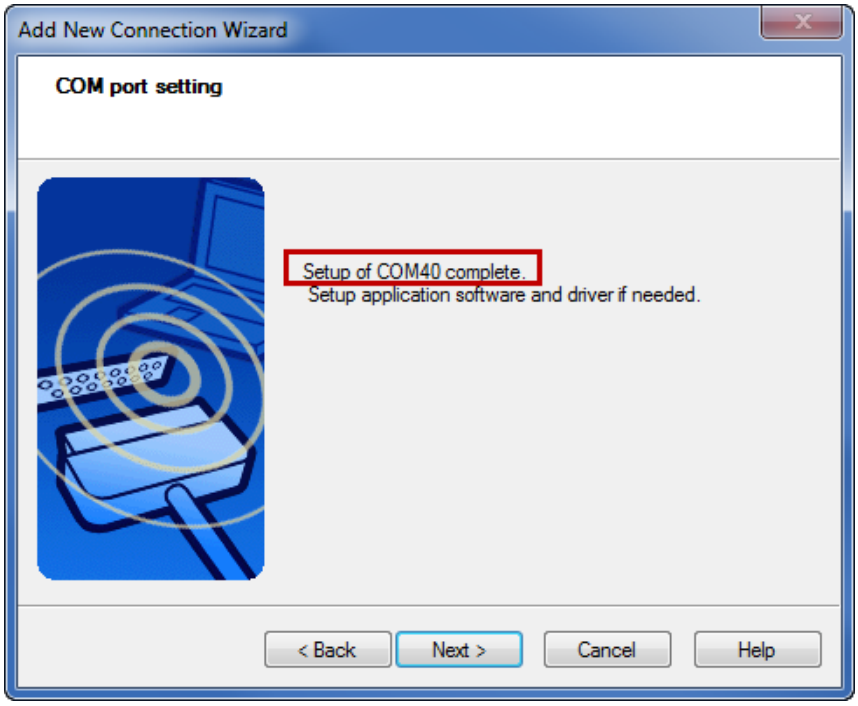


Figure 7 Com port setting

Open the AquaScan 620L software and choose Preferences, then select the matching Com Port in the drop down.

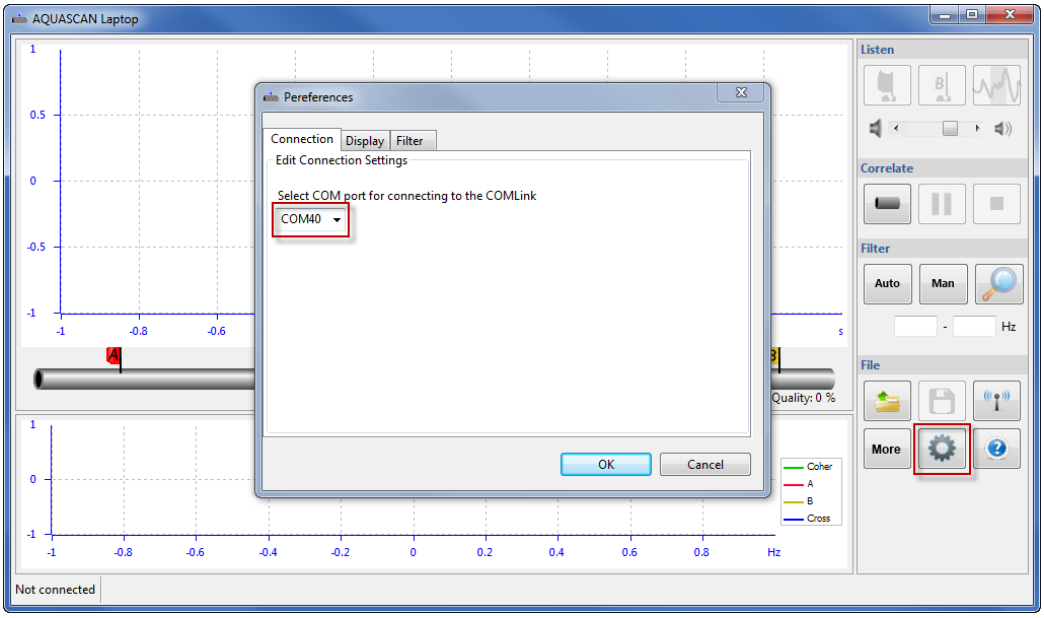


Figure 8 Match the Com port in AQ 620L Software

Tap the Antenna symbol to connect to the Commlink which appears in the bottom right of the main screen.

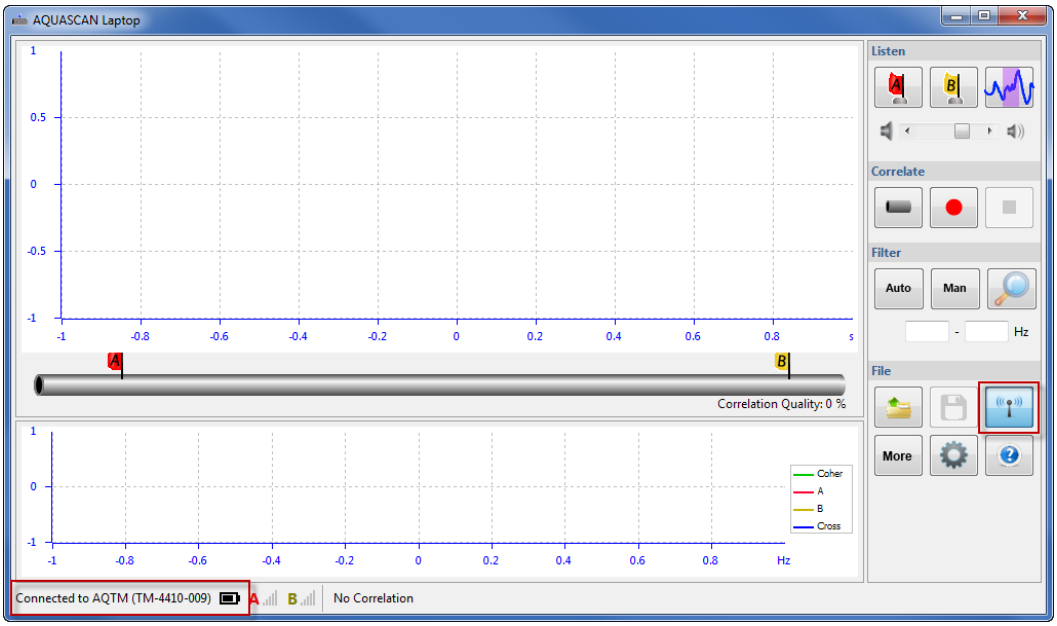


Figure 9 Connect to the Commlink

1. Deploy both Sensors by magnetically attaching them to the pipe fittings. If hydrophones are used ensure the water connections are leak free.

Figure 10 switch on the Sensors

Switch the sensors on by pressing the push button on the top for 1 second until the red LED is on constant before walking back towards the correlator which should be located half way. The A and B Signal symbols within the main screen will display a signal strength indicating communication. Try to achieve a minimum of 3 bars signal strength- the higher the signal the better the data transfer. Optimise Antenna location and sensor contact to create the clearest signal if not already achieved.

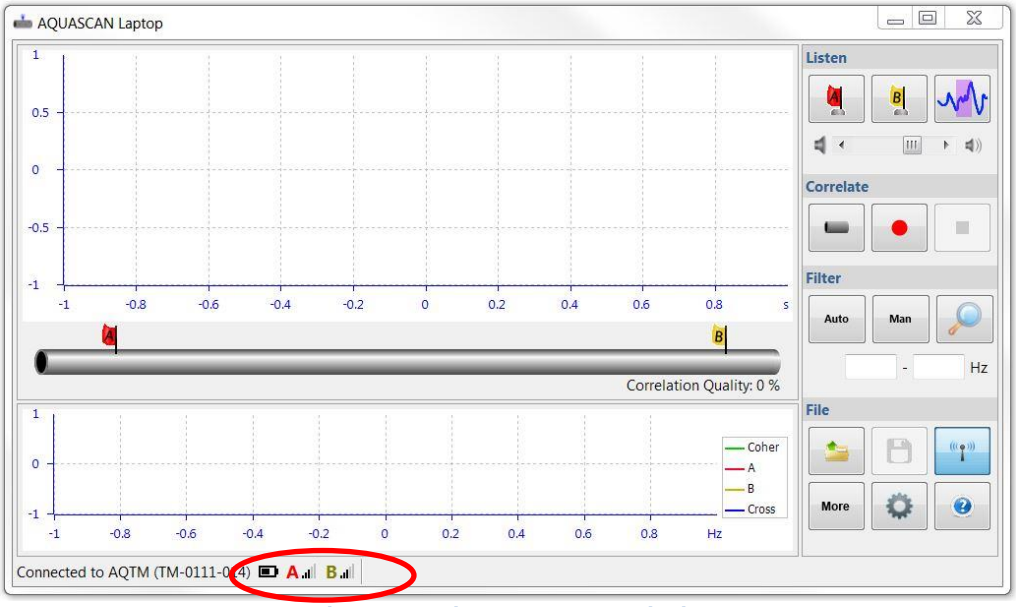


Figure 11 the sensor symbols

2. It's important to listen to both sensors before correlating to make sure that a clear sound is being heard. Use the A and B flag buttons to choose either or both sensors. Listen to the filtered sound by clicking the wave symbol left of the A and B flags.

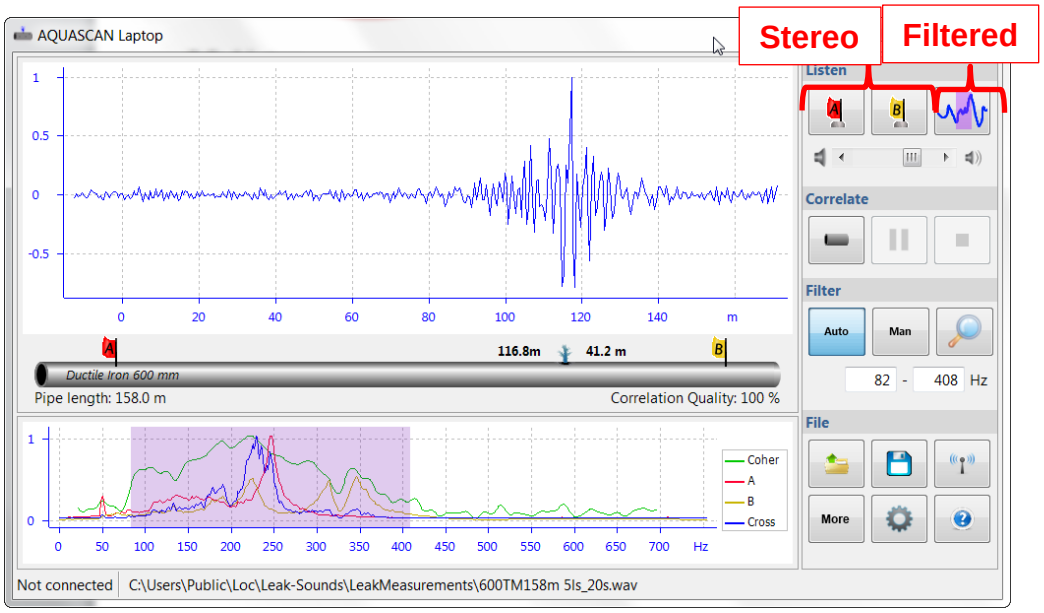


Figure 12 Listen to the sensors

Use the actual buttons on the Tablet to adjust the volume to suit.

Figure 13 Volume Adjust

3. Press the **Pipe** key and enter distance (measured between sensors with a wheel) and material or sound velocity. Verify the indicated data below the symbolic pipe in the chart.

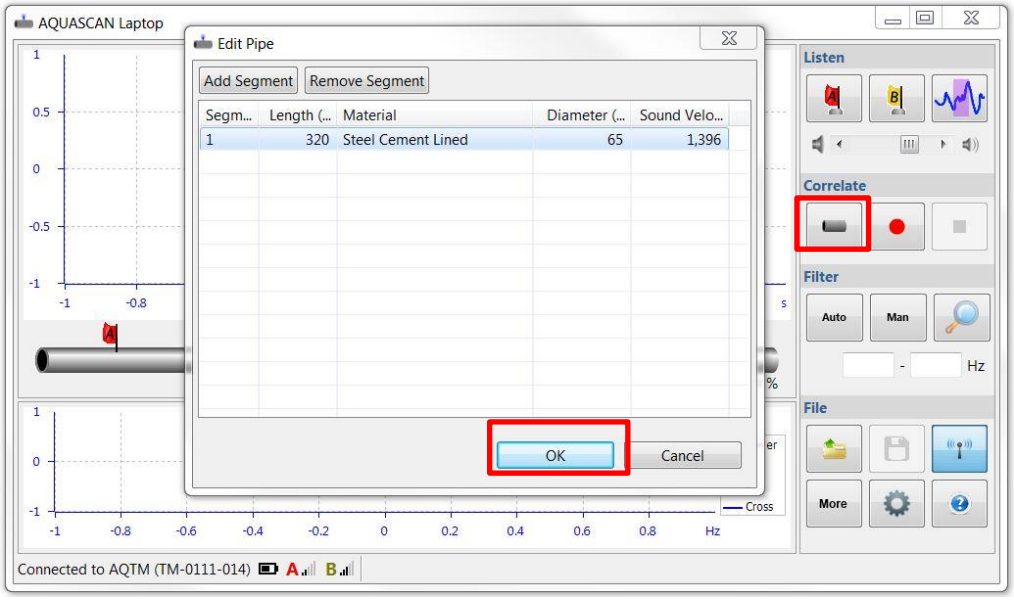


Figure 14 enter Pipe information

Start the correlation process by tapping the red spot button. Allow the process to continue until a good quality correlation of 80%> is achieved. This may take 15 to 20 minutes for difficult, quiet leaks. The longer the duration of correlation the more data is collected by the software for analysis which can lead to a more accurate result.

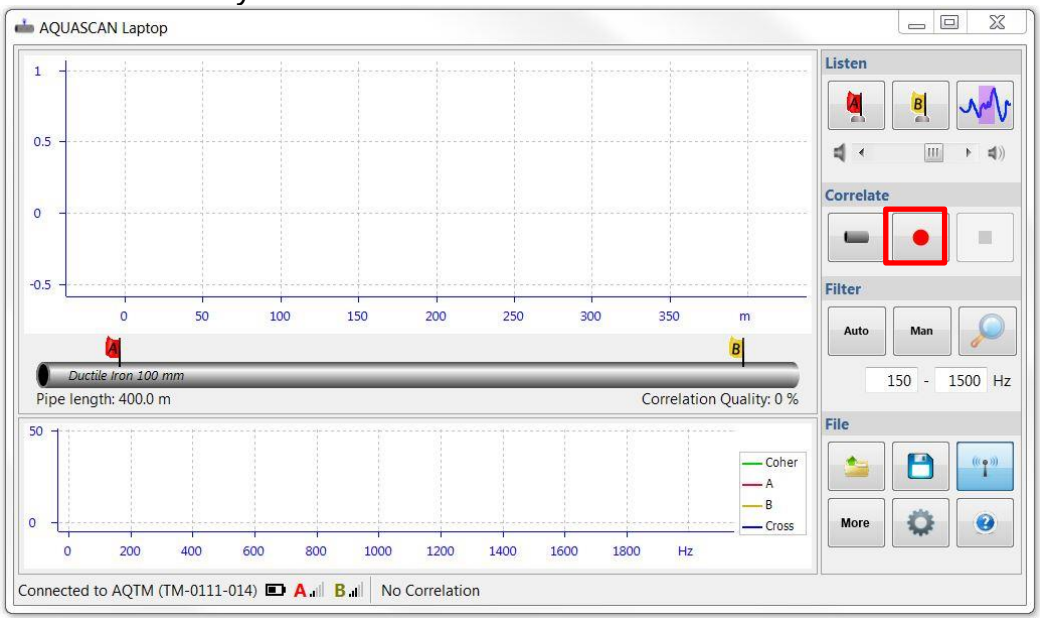


Figure 15 Start Correlation

The correlation process maybe paused or stopped at any time by using the standard buttons shown below.

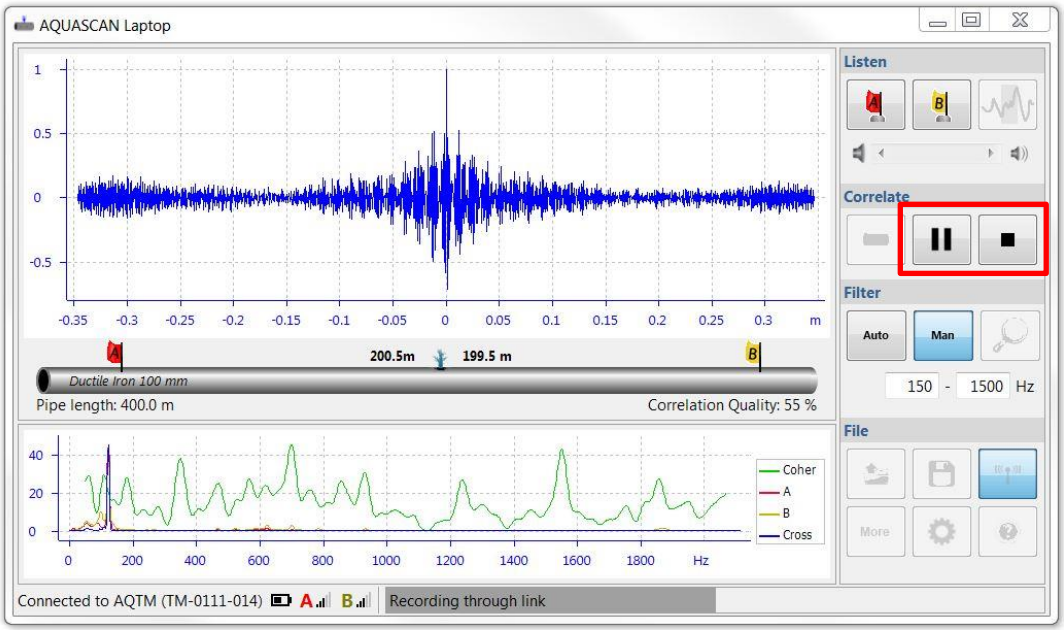


Figure 16 Stop the Correlation

4. To activate the filters tap the **Auto** button and one or two automatically generated filter regions will appear. The user can switch between the filter regions. See filter section for a detailed explanation. **8.** Adjust the filter setting to enhance the measurement quality and cleanness (reduced minor peaks and spicks).

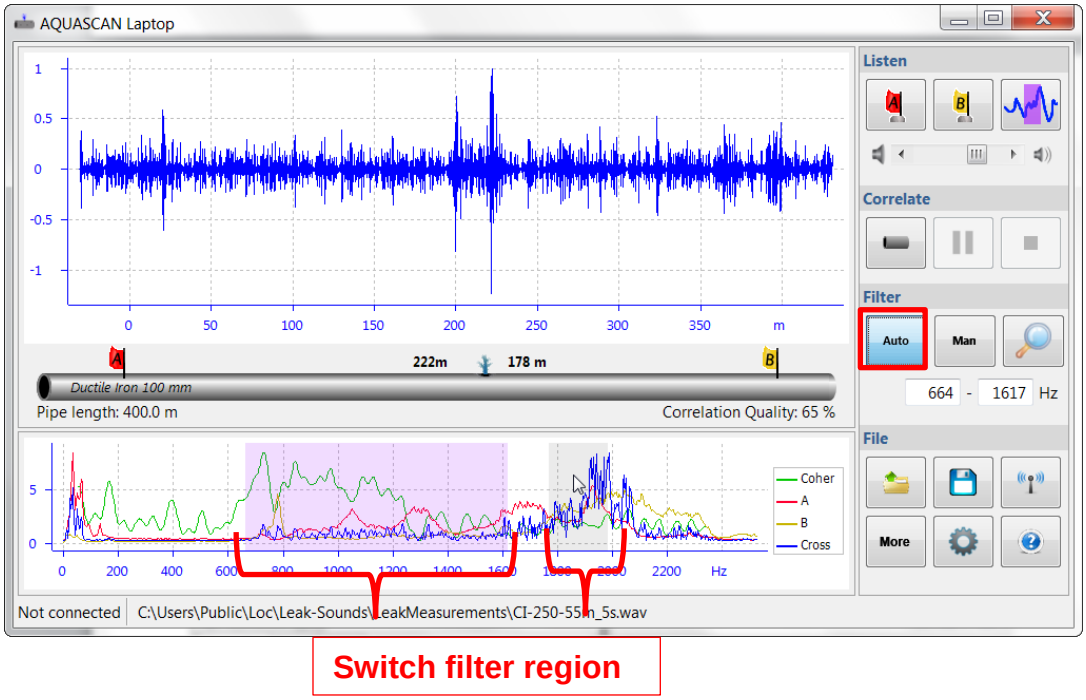


Figure 17 Auto Filters

If the user prefers to use a Manual filter then tap the **Man** button and enter the low and high limits to create a band pass filter. The buttons on the tablet can be used by highlighting the low or high band and pressing the up or down arrow until the preferred value is found.

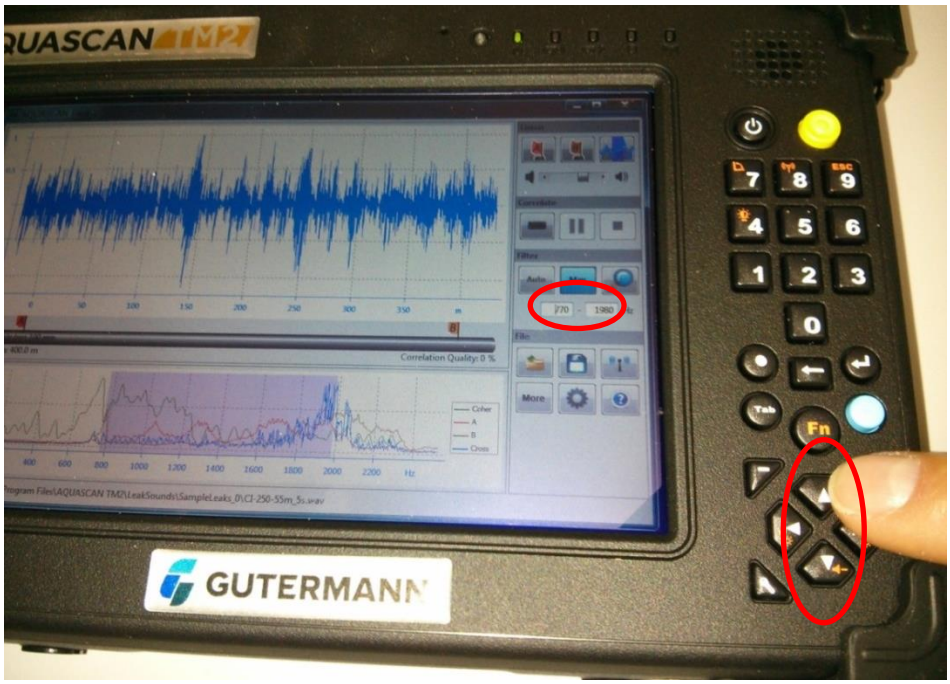


Figure 18 Manual Filter

Tab the looking glass symbol to activate the spot filter which cleans up the correlation by removing the majority of background noise and focuses on the selected peak. Tap in the correlation window to select different peak positions.

Before:

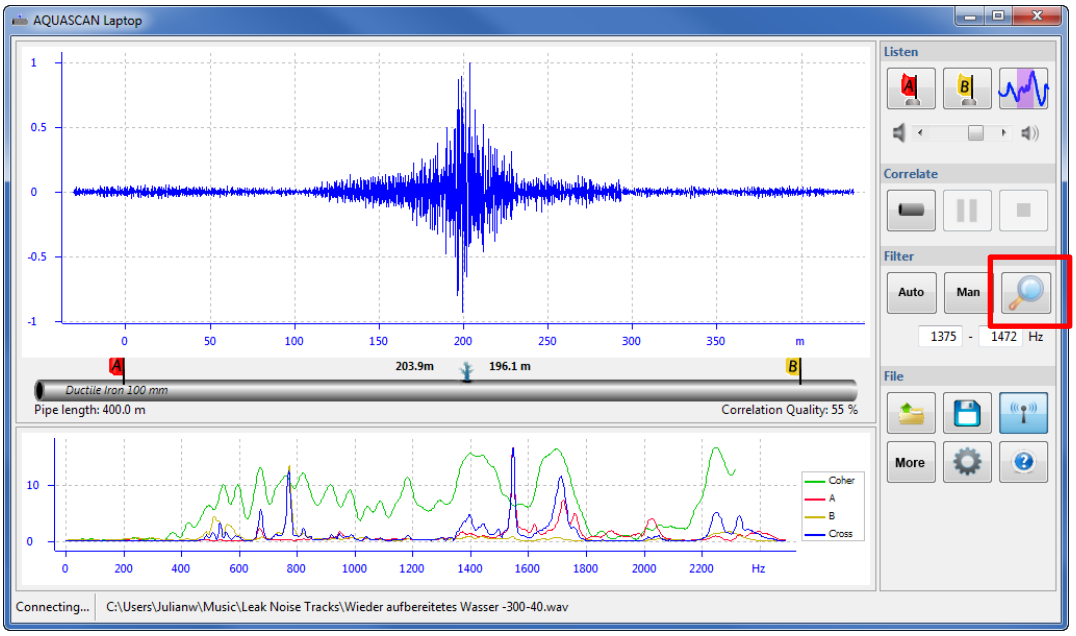


Figure 19 before applying Spot Filter

After:

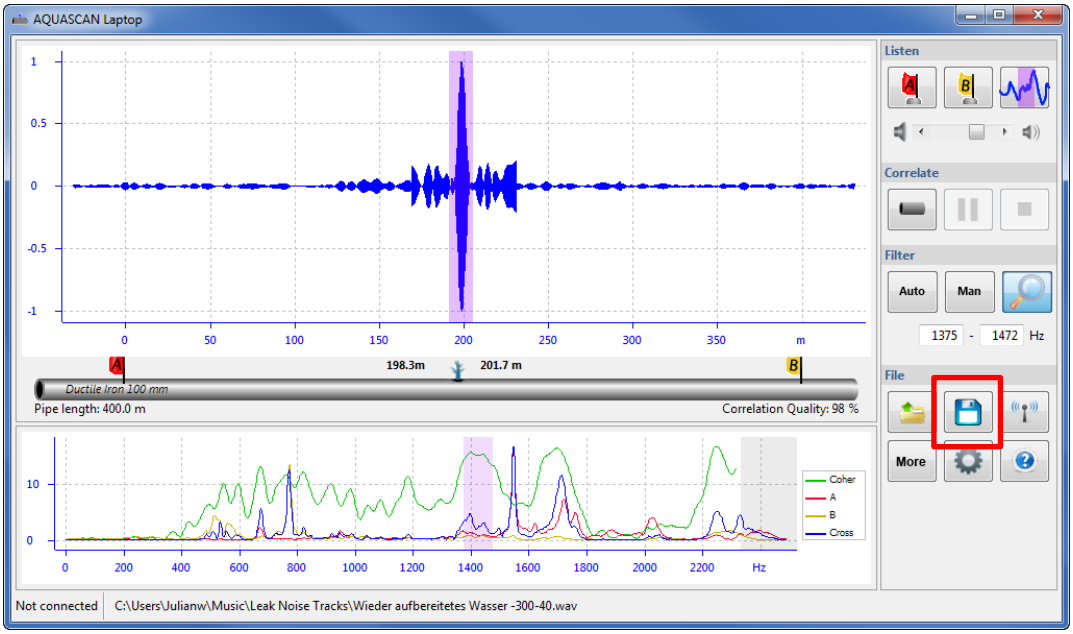


Figure 20 after applying Spot Filter

5. Press the **Save** key shown above (otherwise this measurement will automatically be deleted when starting a new measurement).

Figure 21 save measurement

Use the return key on the tablet to save the measurement.

Figure 22 Scroll through saved measurement

Scroll through the saved measurements using the arrow keys above.The AQUASCAN 620L software also may be run off-line, allowing further analysis, correlating saved measurements, print-outs, etc. without being connected to the Commlink .

3. Sensors

Figure 24 Side View of B Sensor

Figure 23 Top View of B Sensor

For switching the sensors on or off, please press on/off button for at least one second.

The Sensors will remain on for a period of 2 hours for continuous use, thereafter they will turn off. This is a battery saving facility, when this happens the signal indictor on the software will turn off. To turn the sensors back on repeat the first step.

The sensors have a built-in rechargeable battery. For recharging the battery the sensors have to be connected to the charging unit. In off state the LED will flash during recharging. As soon as the battery is fully recharged, the LED will stop flashing.

The Sensor Battery should last 8 hours whereas the Commlink is 12 hours.

Charge warning: When battery is almost discharged during operation mode, the LED will start flashing about twice per second. Further operation will be possible for approx. 30 minutes. When battery is discharged, the sensor will shut off automatically.

3.1 Positioning of Accelerometers

Figure 25 the 'A' Sensor attached to a valve spindle

It is critical the accelerometer is positioned in the location that has the least interference and the clearest leak noise. Moving the sensor 10 cm can make a massive difference to your performance. The listen function (refer to page 35) should always be used on sensor deployment and the sensor should be positioned so that the highest frequency noise is heard minimising the effect of electrical and mechanical noise.

- Connecting on a flange is often better than the pipe itself.
- Connecting on the spindle of a valve is often better than the body.
- Air valves usually make less noise when they are open.
- Big bodied valves with offset spindles often provide very poor noise and the pipe or flange is much better.

3.2 Installation of Hydrophones

- Connection of cable disables the accelerometer
- Blow in Hydrophone and use the listen buttons on the Main Screen to check the sound is audible.
- Flush Tapping.
- Connect Pressure gauge to check the pressure
- Connect the hydrophone with the tapping valve shut, and then fully open the valve ensuring the tapping is completely open.

Figure 26Thread taping the adaptors

- Ensure there are no leaks on any of the fittings between the hydrophone and pipe. PTFE or Thread tap should be used to create a water tight seal.
- Bleed the air from the hydrophone
- Check the bleed has sealed (see instructions below to seal)

Figure 27 Hydrophone with Bleed valve

Sealing / cleaning instructions for Hydrophone bleed. Occasionally grit may become trapped in the bleed valve preventing it from fully sealing. Unscrew the bleed valve using a flat blade screwdriver and inspect the mechanism for grit, clean and remove any particles.

Note: Do not clean bleed valve when the Hydrophone is under water pressure.

Figure 28 removed Hydrophone Bleed Valve

4. Main Screen

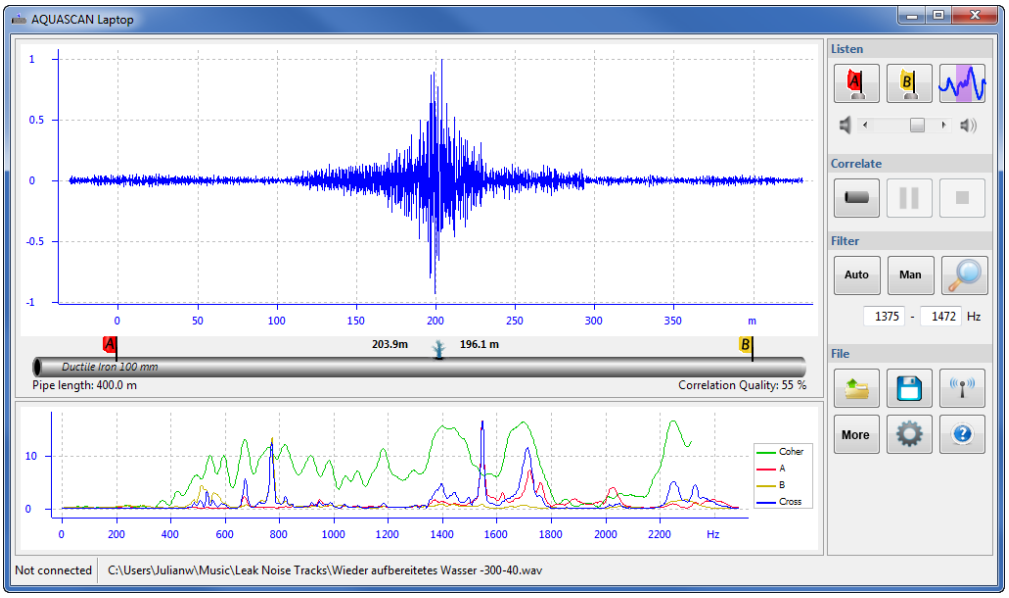


Figure 29 Main Screen Shot

This window shows detailed information about **leak location** measurements and allows the user to carry out new measurements. It has a task part on the right hand side, and a result part which consists

of a graphic display of the measurement, a presentation of the location on the pipe, of the signal level and the correlation level.

4.1. Measurement Graph/Chart

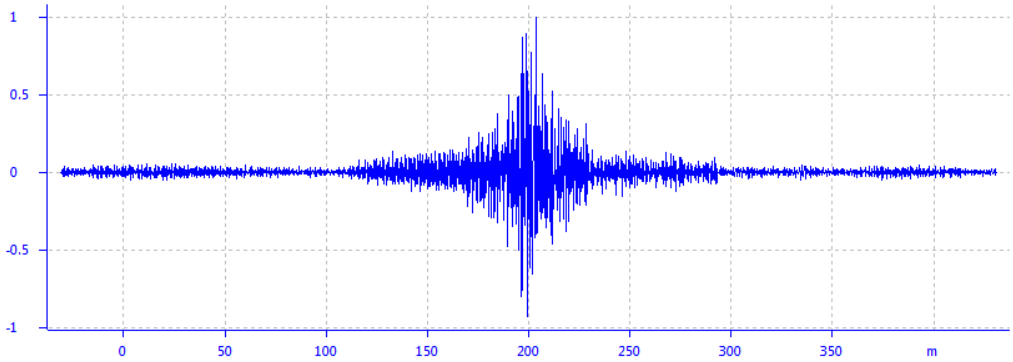


Figure 30 Unfiltered Correlation Graph/Chart

The measurement chart(s) display(s) the processed measurement data for a visual evaluation and analysis of the measurement result. The Graph shown above is an example of a positive/negative unfiltered graph.

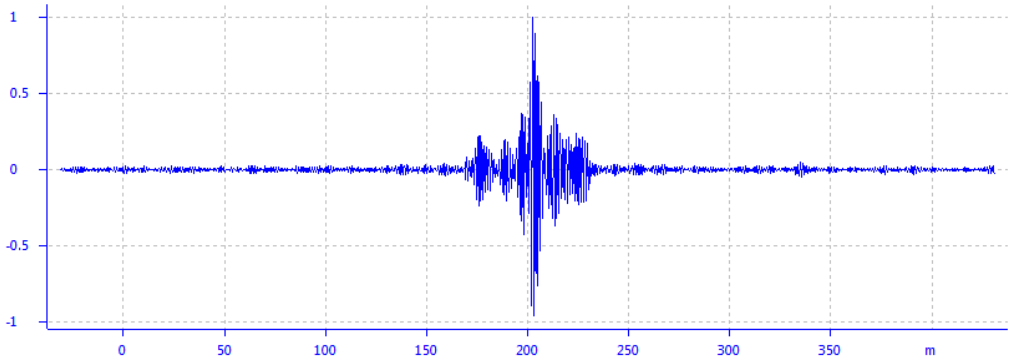


Figure 31 Filtered Correlation Graph

There is a combination of negative and positive correlation values in a correlation; this is shown above in the filtered measurement. For user comfort only positive values are displayed in a normal correlation graph.

From a mathematical definition, a correlation function always has positive and negative values. The main peak is normally positive. When it is negative, it may be because it is from a resonance.

4.2. Leak Location

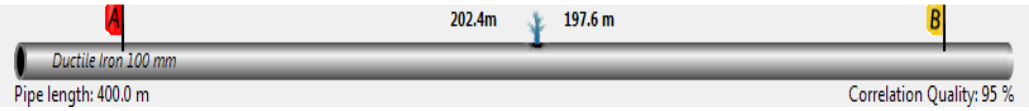


Figure 32 leak location

The pipe image displays the result of the correlation measurement. The calculated position of the leak results from the position of the peak in the measurement chart. If the pipe consists of one single material the blue leak symbol on the pipe is located directly under the peak of the measurement chart; otherwise its position is different. The small rectangles show the position of sensors A and B, and the numbers indicate the distances between the leak and both sensors.

Note: The measurement results are not assessed. The software will always calculate and display a maximum or peak as a leak. Therefore, a visual judgement of the quality of the measurement results is important.

4.3 Correlation Quality

Below the pipe image is the Correlation Quality, the greater the percentage means the higher quality the correlation.

4.4 Indicators

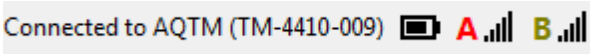


Figure 33 Radio Connection LED indicators

The bottom left corner will inform whether or not there is a connection with the Link unit, no connection or Connection to AQTM-xxxx-xxx. When there is a connection with the Link unit, the sensors A and B will show signal strength if the sensors are in range.

Battery: When connected to the computer, the battery symbol will show the battery charge level of the Link unit.

4.5 Correlate- Start, Pause and Stop measurement

Figure 34 Action Keys

By clicking these keys you can start, interrupt or stop a new measurement (from left to right, only when the Link unit is connected).

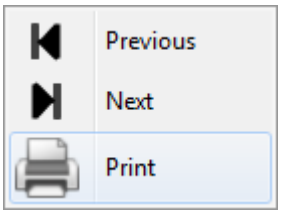
Figure 35 save Key

Attention: After completion of a measurement, it is stored in a temporary file on hard disk. To save it permanently, press the **Save** key - otherwise it will be deleted when a new measurement is started.

4.6 File Keys

Figure 36 File Key

- **Folder** – To browse and open a saved correlation wav file
- **Save File** – To save a correlation as a wav file
- **Transmitting Antenna** – To connect to the BT paired Commlink
- **More** – Allows the user to go to the previous or next saved measurements or print the current displayed correlation



- **Cog Symbol**- enter the menu for various options/settings
- **?** – Opens a help file

4.7 Listening to the Sensors

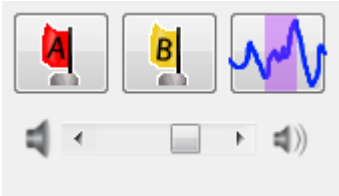


Figure 37 Listening key and Volume Slider

Press **Sensor A** and or **Sensor B** for listening to the sound signal recorded by sensor A or sensor B. Listen to the Filter sound by tapping the sound wave symbol. Adjust volume with the **Volume** scrollbar.

4.8 Filter Keys

Figure 38 Filter Keys

Auto Filter key, when pressed the software will apply calculated filters on the measurement result. The user must set the Man filter by entering the low and upper limits in the frequency windows. The looking glass symbol is a spot filter that emphasizes the selected peak(s) and reduces the background noise.

4.9 Settings

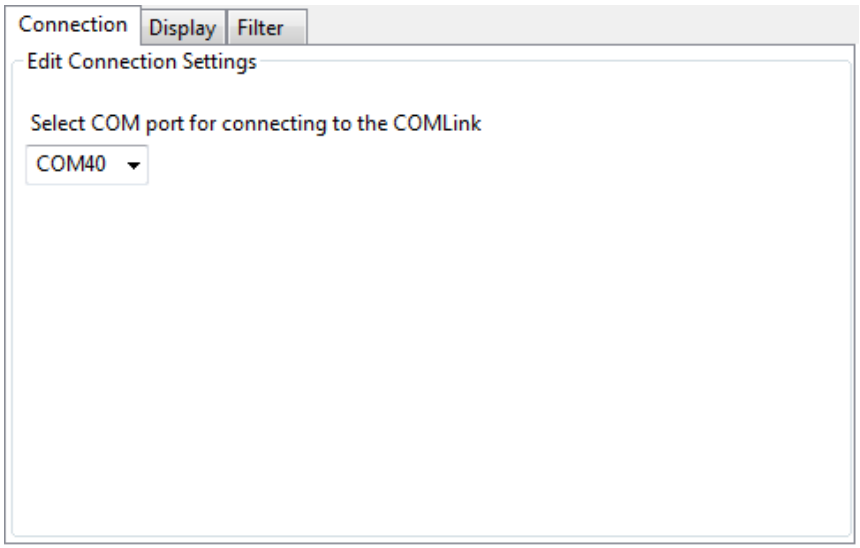


Figure 39 Settings window

When the Cog symbol is tapped a separate window will appear with 3 tabs. The connection tab is simply to select the correct com port that the link is Bluetooth paired with.

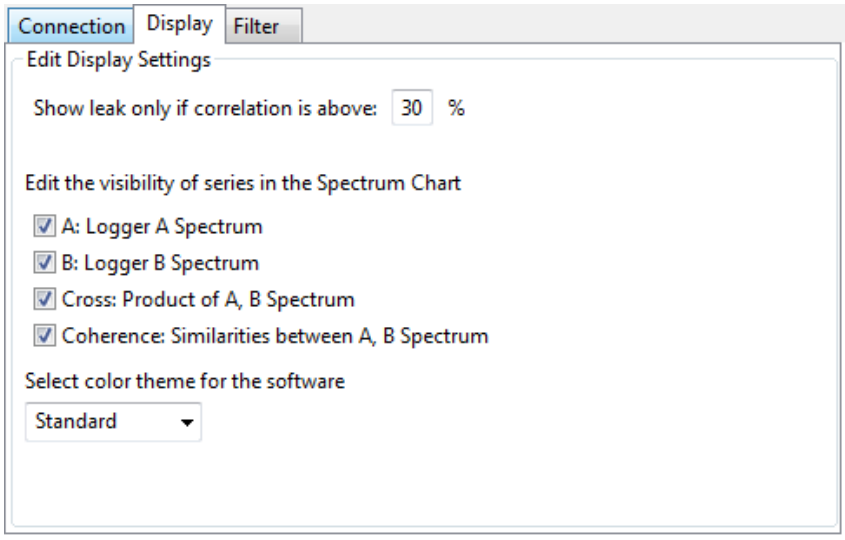


Figure 40 Display Settings

Within the display tab there are many options. The top line, Edit the display settings is in reference to the pipe symbol. Adjust the percentage for when the leak symbol is displayed. 70 to 80% is recommended.

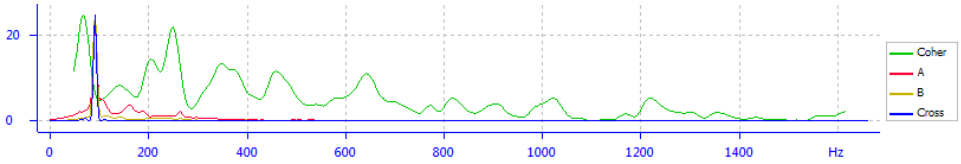


Figure 41 Spectrum Chart

Edit the visibility of the series in the Spectrum Chart options allows the user to choose to show the various spectrum lines. By ticking the box next to Logger A, Logger B, Cross or Coherence will make the lines visible. Removing the tick(s) will make the line(s) invisible. The Cross spectrum is the (complex) product of the spectra of sensors A and B. The coherence is a measure of the similarity of the signals of both sensors and often is a good indication of the leak frequencies.

The Notch filter and associated higher frequencies remove electrical interference which is often found on Transmission/Trunk mains.

5. Working with Correlation Recordings

Open File allows the user to select a previous recording by highlighting the desired file name in the chosen folder.

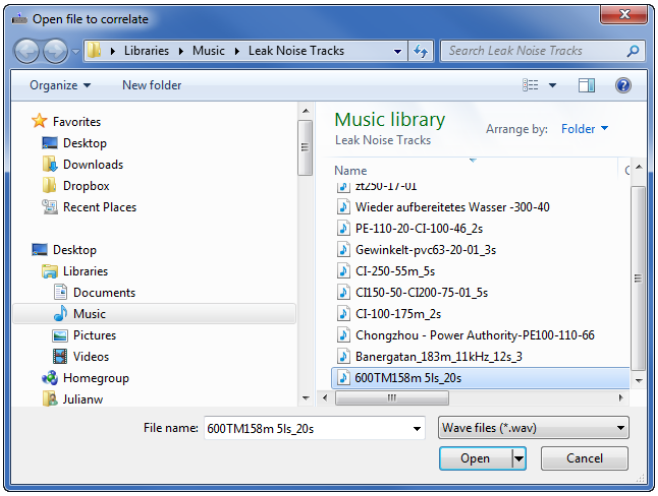


Figure 42 Open File to Correlate Window

Share the file by attaching the wav file to an email or by saving the file to a USB memory stick/drive. A colleague running the AQ TM2 software in another location can view and analysis the correlation by opening the wav file as mentioned above.

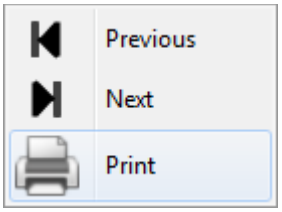


Figure 43 Print a Correlation

Print: Print out the measurement which is shown on screen. After selecting this function a window will appear, where the user can select the printer, page range and number of copies then tap print.

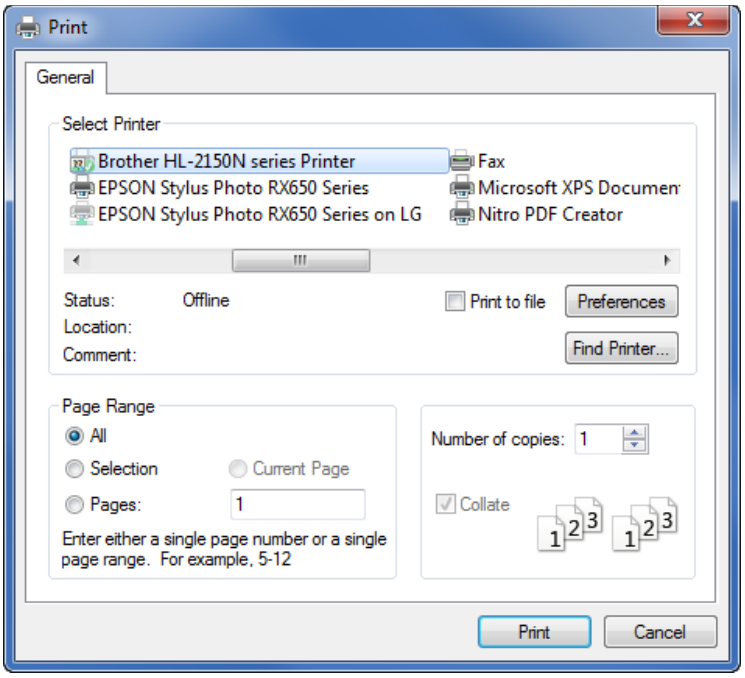


Figure 44 Print Options

6. Entering Pipe Sections

This is normally the first step when initiating a leak measurement at a new site.

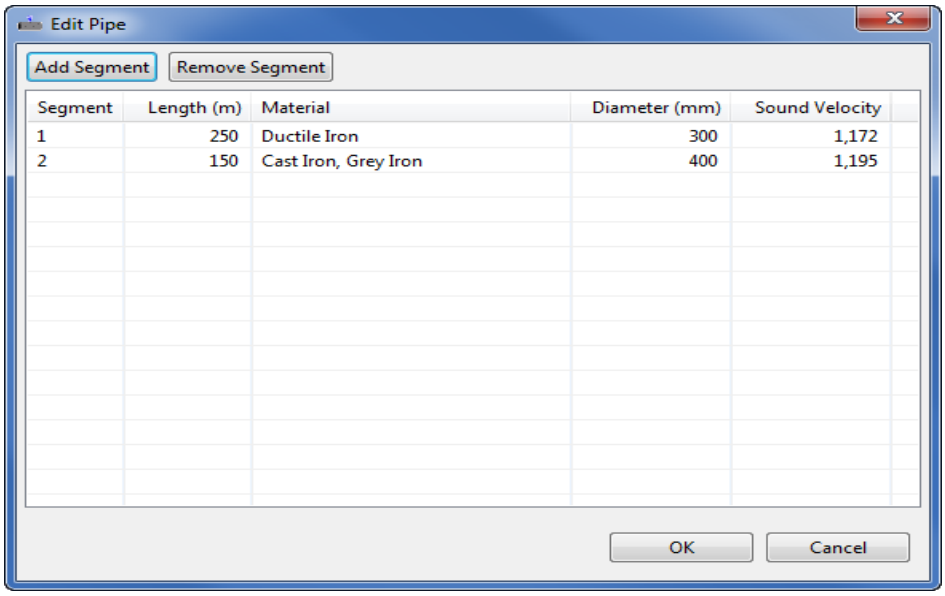
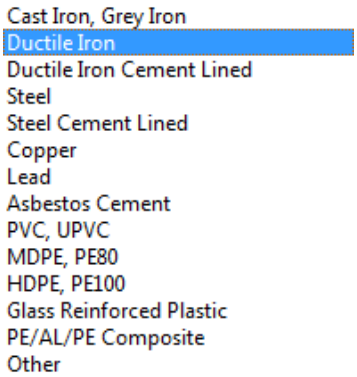


Figure 45 Entering Pipe details

You have to enter the following settings:

If the pipe section between sensor A and sensor B consists of one material with a constant diameter, **Total:** is **1 segment** (to be set with the arrow key or with the keyboard). Type the length by using the numeric keys or the virtual keypad. Tap the material box and use the drop down menu to select the correct type, see below:



Repeat the same process to choose the diameter of the pipe. In all other cases, each section with different materials and/or different diameters has to be entered individually. For each additional section tap Add Segment and enter the length, material and diameter. We always start from Sensor A working towards Sensor B, i.e. 2 sections, measure distance form Sensor A to change in pipe then next section from this point to Sensor B.

The correct sound velocity is very important for the precision of the leak location result. The nearer the leak is to one of the sensors (creating a large time delay), the more accurate the velocity value must be. It is very important to understand that the sound velocity table, defined by pipe material and diameter, is only theoretic and that the specific real velocity might differ from site to site. We recommend that whenever the measurement shows a leak position which is not in the middle third section of the total distance between sensors A and B, the real on-site sound velocity should be verified. This can only be done when the pipe material to be verified is homogeneous, i.e. is a single material and diameter.
If the sound velocity of the pipe is known then this can be manually enter in the box using the numeric keypad or virtual keyboard.

7. Filter

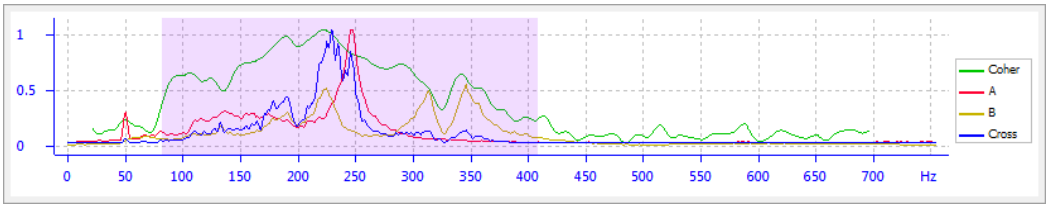


Figure 46 Filter Window

The correct filter setting may be of great importance for a precise measurement result under particularly difficult environmental conditions. In the **Filter** section the filter setting can be adjusted to the specific measurement conditions.
The filtered leak measurement contains all the signal parts of the unfiltered measurements between the lower and the upper frequency limit.

The present filter setting is indicated in the two fields under the Auto, Man and spot filter buttons. In the **Spectra** window the frequency limits are marked by the highlighted section.

7.1 Notch Filter

The Notch Filter for electrical interference should always be activated for Trunk Main Leak Detection as this is prevalent on most Trunk Mains. The option to reduce higher harmonics should also be activated as this electrical interference often cycles at higher frequencies too.

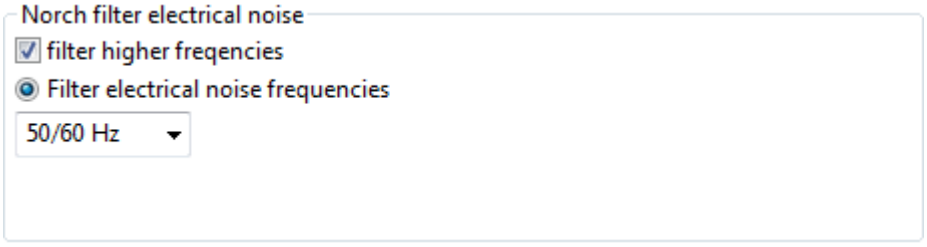


Figure 47 Notch Filter

The choice between 50HZ or 60HZ depends on the electrical supply in the country you reside. EG USA and Philippines = 60HZ, Most of Europe, Australia, New Zealand, Singapore, Malaysia = 50HZ.

7.2 Manual Filtering

The first step in manual filtering is to set a filter bandwidth that incorporates the entire frequency range generate by the leak or leaks 0 to 2000Hz. If you suspect multiple leaks this may need to be broader, however if you want to focus on identifying one leak at a time use a narrower frequency band. Typical band widths may range from 100 to 350 HZ; start with 250HZ and then adjust accordingly.

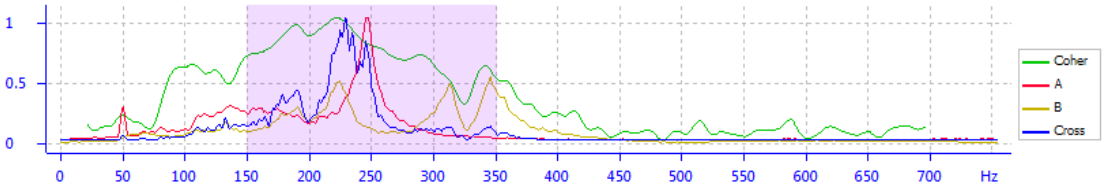


Figure 48 Example of setting Manual Filter

Try narrowing down the bandwidth by adjusting the lower and upper limits to create the cleanest correlation possible. The peaking of the Coherence (green), A (red) and B (yellow) plus Cross (blue) signals are a guide to where to set your limits.

Large diameter pipes are good conductors of low frequency noise As you increase the band frequency you will eventually get to a point where this out of bracket peak is removed and you have an in bracket peak, this is the most likely leak location or locations.

7.3 Auto Filter

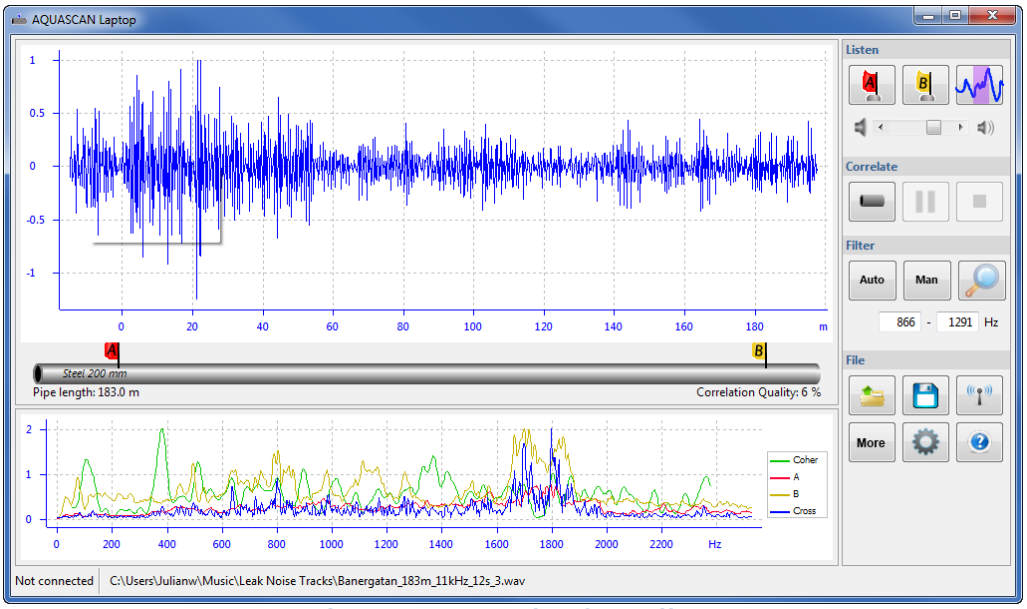


Figure 49 Example of no Filter

The example in figure 66 has no filter applied to the correlation. When the Auto filter is applied in the next example the correlation is a lot cleaner.

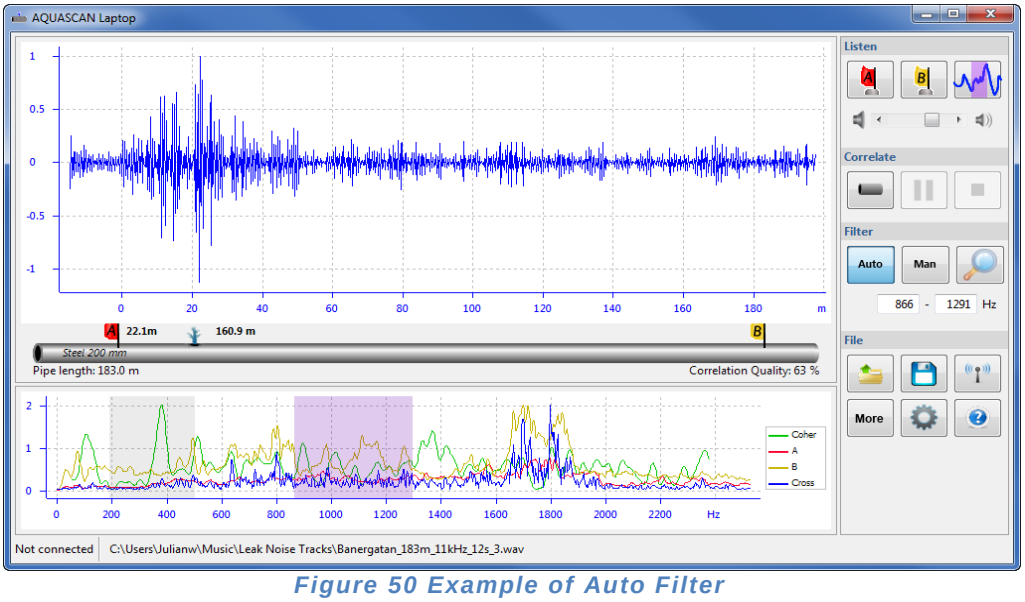


Figure 50 Example of Auto Filter

The purple highlighted block in the Spectra window in figure 67 is the bandwidth which gives the best auto filter result. The frequency of the purple block is shown under the Filter buttons on the left side.

The grey filter region is another possible filter that the software sometimes calculates; try both by clicking on the regions and taking note of the result in the main correlation window.

7.4 Spot Filter (TM2 Only)

Select the magnifying glass symbol to activate spot filtering which automatically picks the highest peak of the correlation graph and magnifies that region. You can then tap at other positions in the correlation graph to filter for possible peaks at that position.

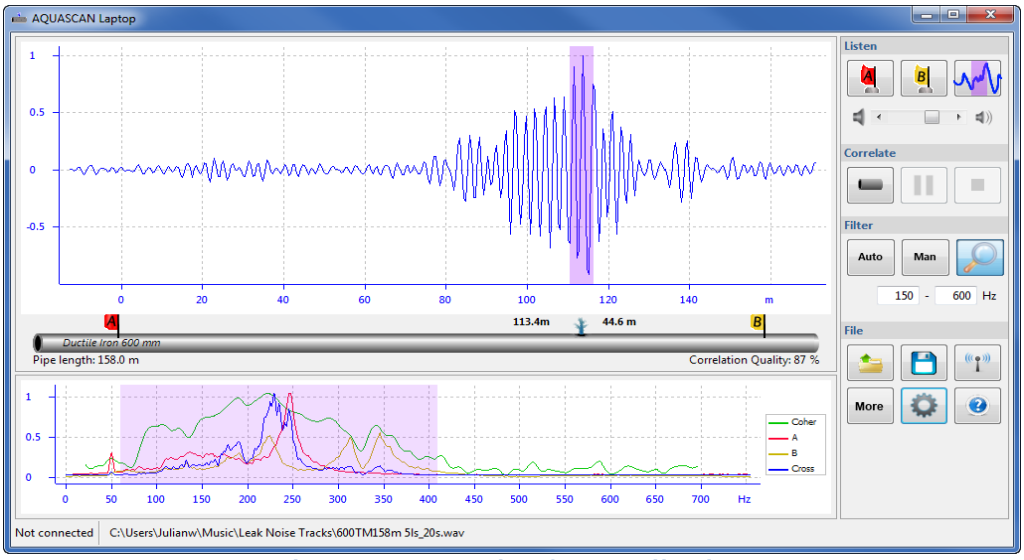


Figure 51 Example of Spot Filtering

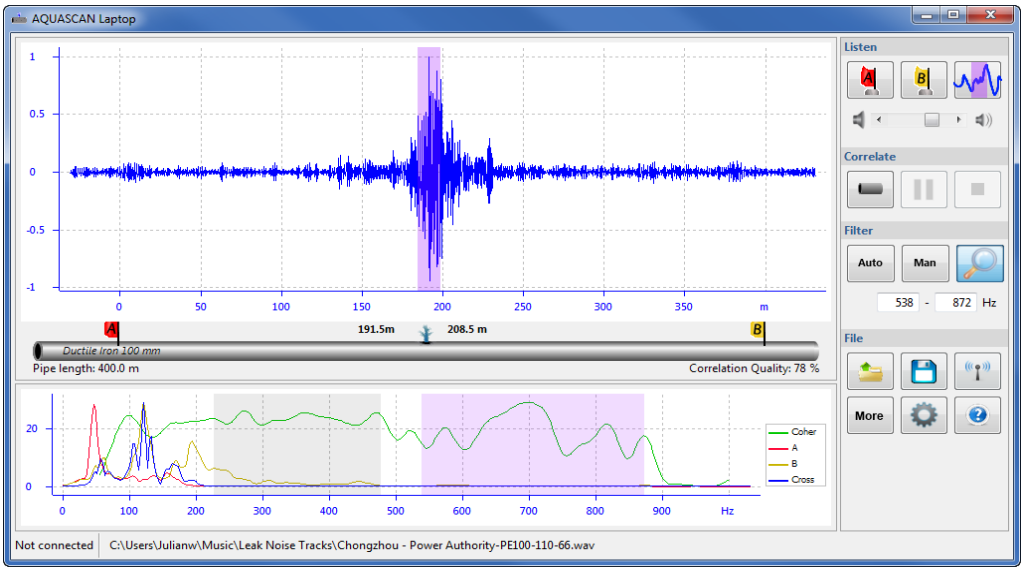


Figure 52 Example of Spot Filtering with 2 possible

The example above has two filter regions, purple which is currently selected and the best filter option.
The grey filter region is another possible option. Use your observation to select the cleanest correlation.

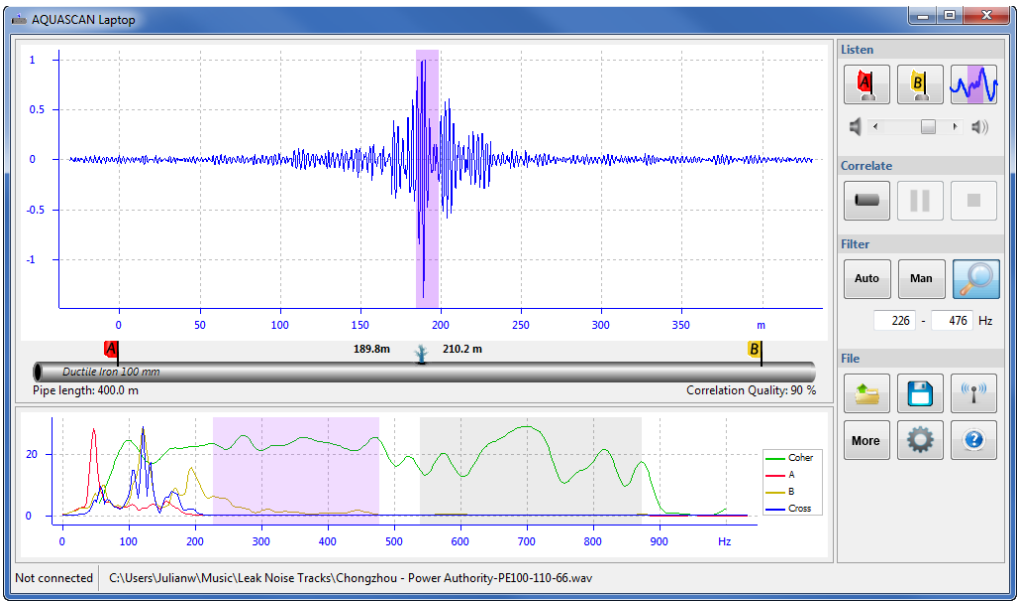


Figure 53 example of Spot Filtering second option

The result of the second possible option is shown above.