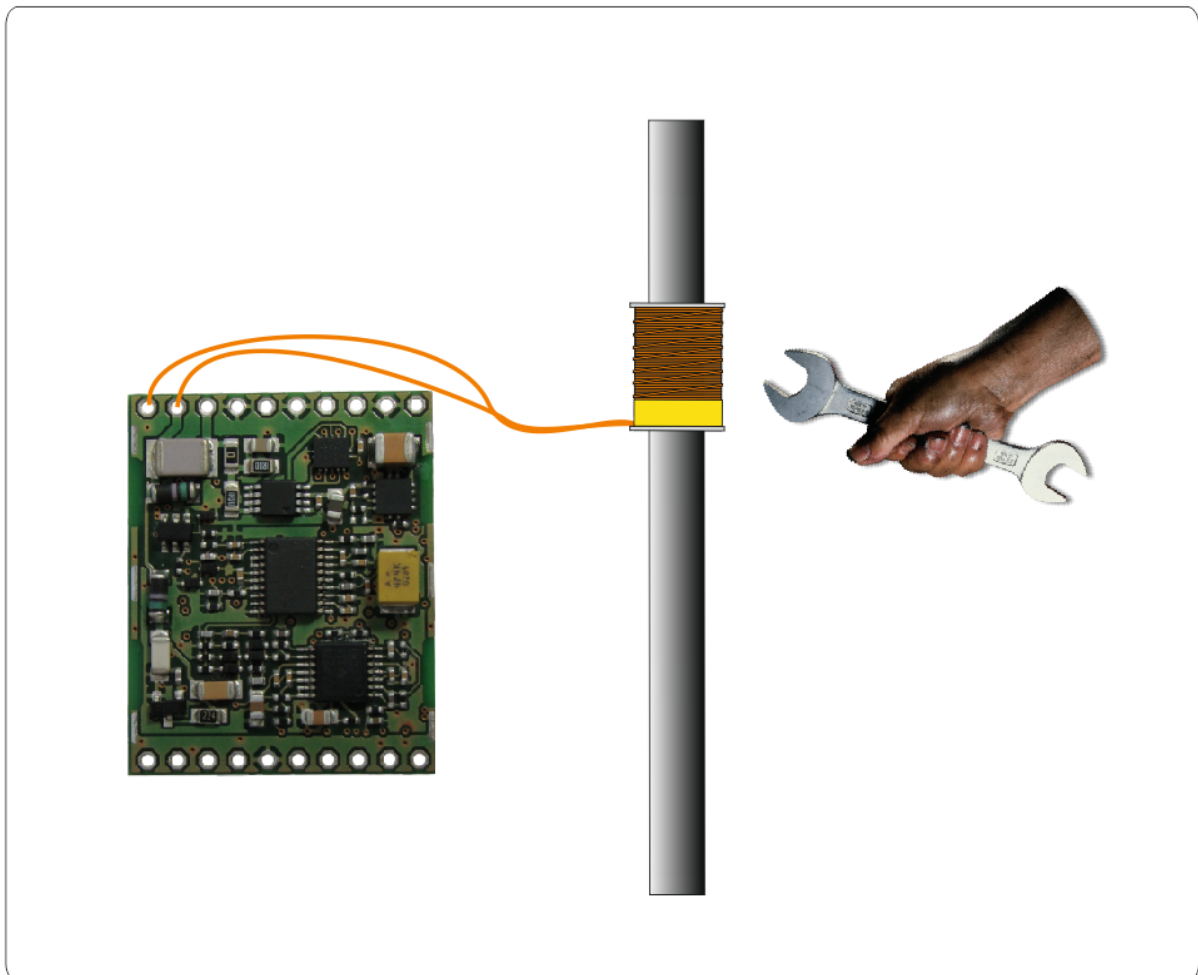




**Agrident GmbH, Steinklippenstr. 10, D-30890 Barsinghausen
Phone +49 5105 582573-10 - Fax +49 5105 582573-17**

ABR200 Antenna Tuning Manual



Firmware 1.00 and higher

V18/12/13

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December 2013

Agrident GmbH
Steinklippenstr. 10
30890 Barsinghausen
Germany
Phone +49 (0) 51 05 582573-10
Fax +49 (0) 51 05 582573-17
E-Mail: mail@agrident.com
www.agrident.com



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1 Introduction

If an antenna is connected to the ABR200 reader module, the antenna has to be adapted to the ABR200 reader module in order to get the optimum reading range. The inductance of the antenna builds a series resonant circuit together with the resonant circuit capacitors on the reader.

The antenna tuning could be done by using an oscilloscope or the PC-Software *ASR-PC-Demo*. Alternatively the antenna voltage can be requested using the corresponding command by any other software or host processor.

For ferrite antennas, which are not already casted, the antenna tuning is pretty easy. If the coil is moved on the ferrite the antenna inductance is changing. The tuning is perfect if the maximum antenna voltage is reached.

In order to have the optimum reading performance, the resonant circuit needs to be tuned to the correct resonant frequency, in this case 134.2 KHz. The resonant frequency depends on the antenna inductance and the capacitance on the reader board.



$$f = \frac{1}{2\pi\sqrt{LC}}$$

f...resonant frequency, here 134.2 KHz

L...Inductance (here in μH)

C...Capacitance (here in nF)

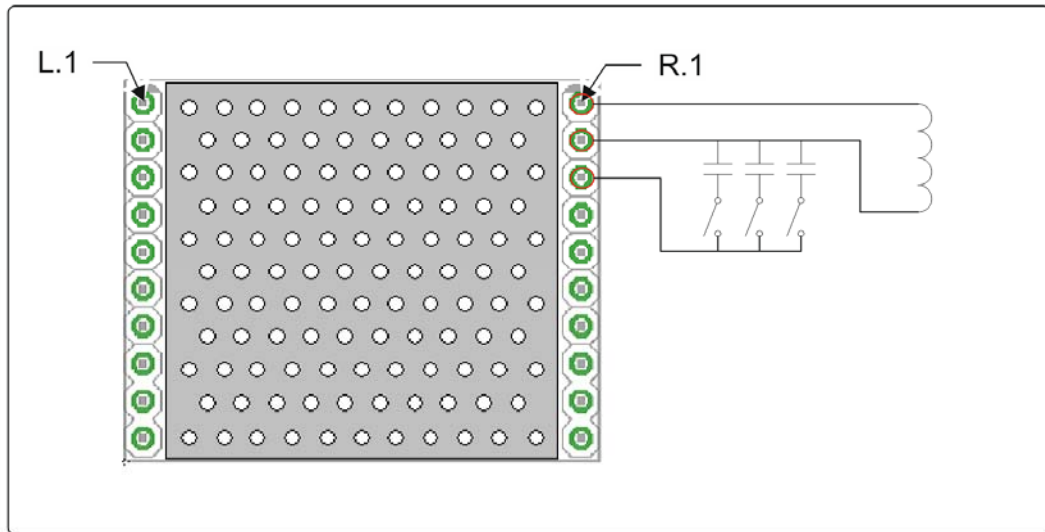
The ABR200 has a basic capacitor with a value of 4.7nF on-board. During the in-circuit-test in production a maximum of 2 more capacitors is added to the reader board in order to match the on-board capacitance to an inductance of exactly 275 μH . That means, if your antenna always has an inductance of 275 μH (plus/minus 1 percent), you should not need to do further tuning. That would also apply if you want to connect Agrident external stick antennas to the ABR200 because these are already factory tuned to 275 μH .

For air-coils and casted antennas the antenna inductance is fixed and cannot be changed anymore. The only way to tune to the correct resonant frequency is to adapt the capacitance to the antenna inductance. This has to be done on the customer's PCB.



Please note that, if you cannot meet an exact target inductance of 275 μH , your antenna inductance must be SMALLER than this value. Then it is still possible to tune to resonance by adding capacitance. Removing capacitance is not possible because this is fixed on the ABR200.

The following picture shows how additional capacitors have to be connected to the ABR200:



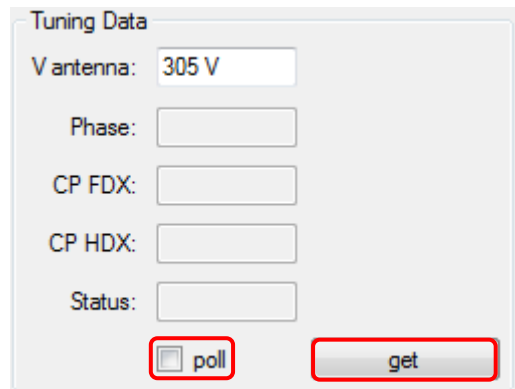
In this example there are 3 additional capacitors, which can be set with jumpers. On a customer's PCB one capacitor (or maybe 2) with the correct value would be enough BUT the correct value is not the same for every unit. The antenna tuning has to be done for every reader individually! Change the capacitance until you have reached the maximum antenna voltage.

2 Tuning the antenna using ASR-PC-Demo

Start ASR-PC-Demo and connect the ABR200 to the software. Go to the "Tuning" tab.

The antenna voltage can be requested from the ABR200 by pressing the "get" button. The voltage depends on the antenna Q (inductance and resistance). In this example the antenna Q is pretty high ($\gg 100$) and thus the antenna voltage is also fairly high (but absolutely ok).

In order to request the antenna voltage repeatedly you can check the box "poll". The PC-Software will request the readers antenna voltage until the box is unchecked again. This can be useful while moving the coil on a ferrite rod in order to tune to the correct inductance.

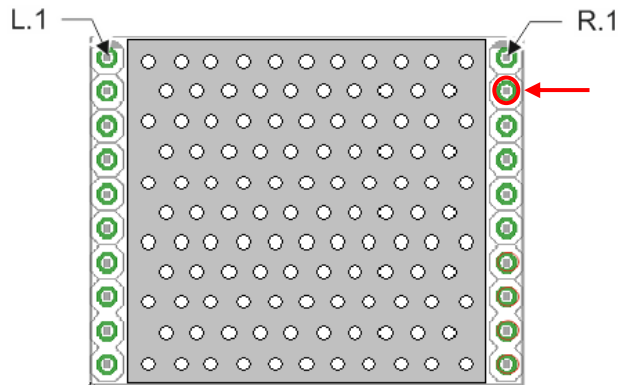


In this example the voltage of the antenna is 305V. This value could differ from the antenna voltage measured with an oscilloscope. Change the coil position on the antenna rod until the maximum voltage is reached. Try to find the maximum very carefully since small changes of the coil position result in big changes of the antenna voltage.

3 Antenna Tuning using an Oscilloscope

It is also possible to tune the antenna to the correct inductance and thus to the maximum voltage using an Oscilloscope.

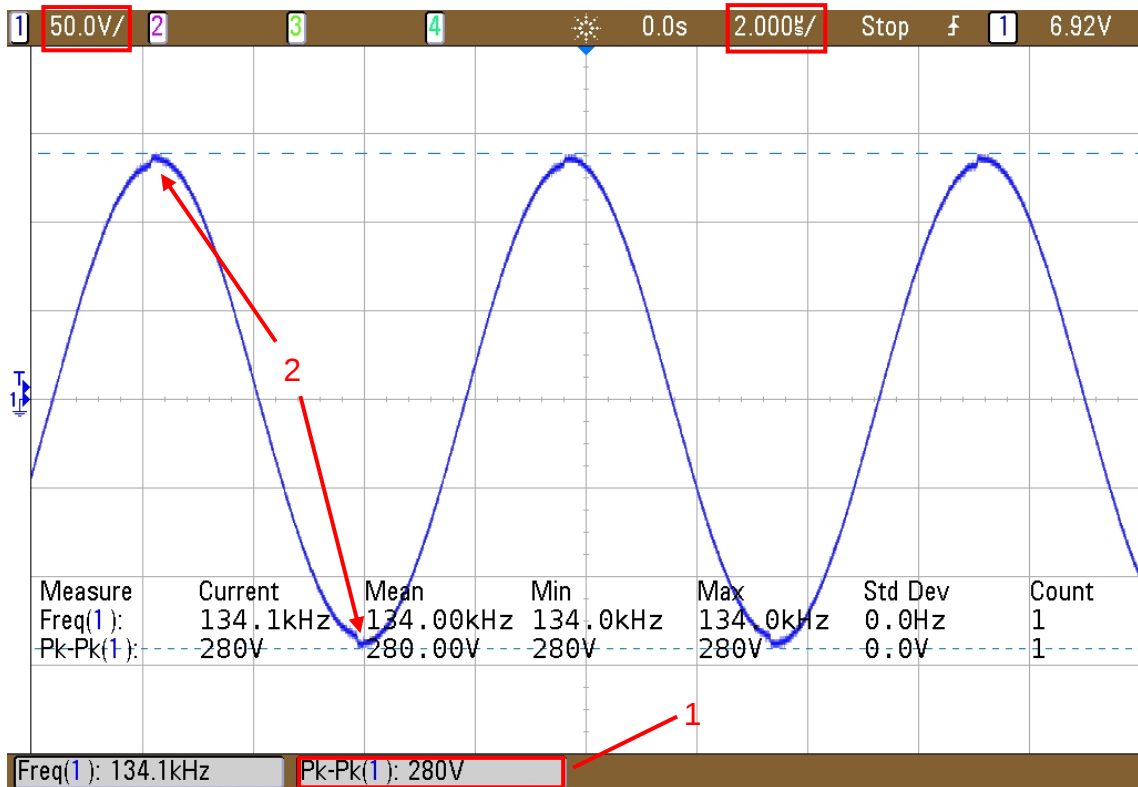
Connect the oscilloscope to Pin2 of the right connection terminal – that is the high voltage side of the resonant circuit.



The oscilloscope settings for the following examples are:

Channel 1: 50Volts/Div
Time: 2µs/Div
Trigger: Auto
Measurement: Peak-Peak and Frequency

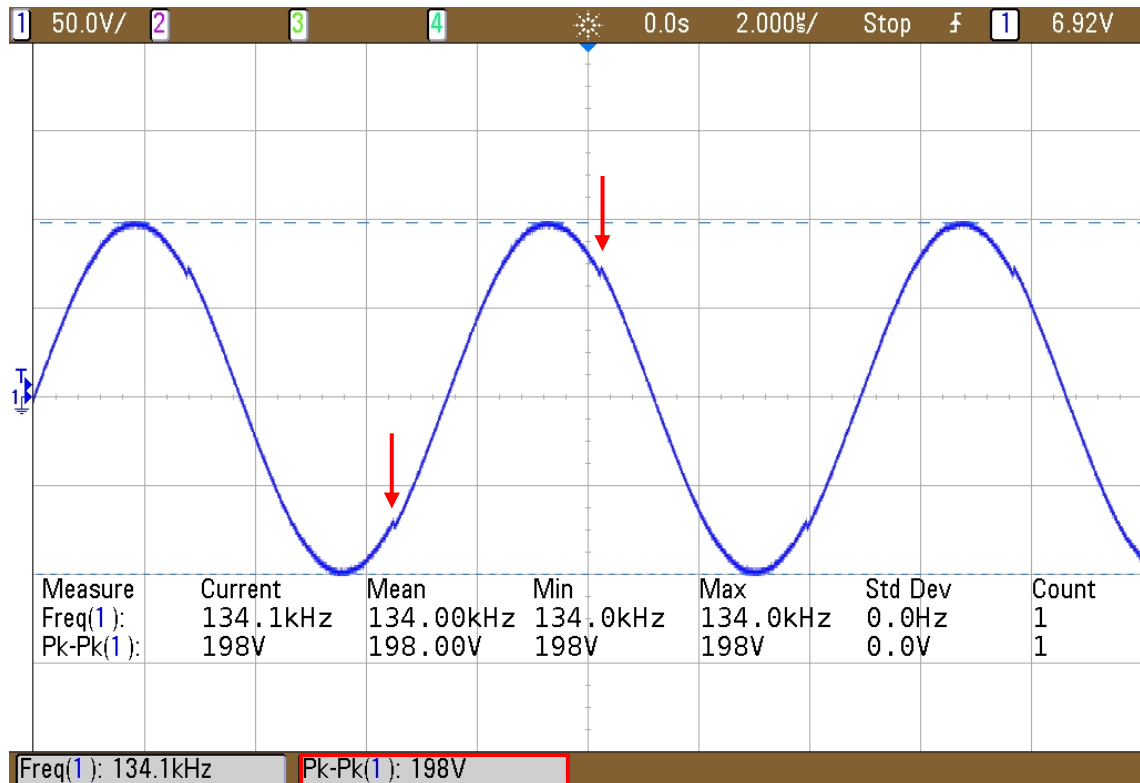
Example for a correctly tuned antenna:



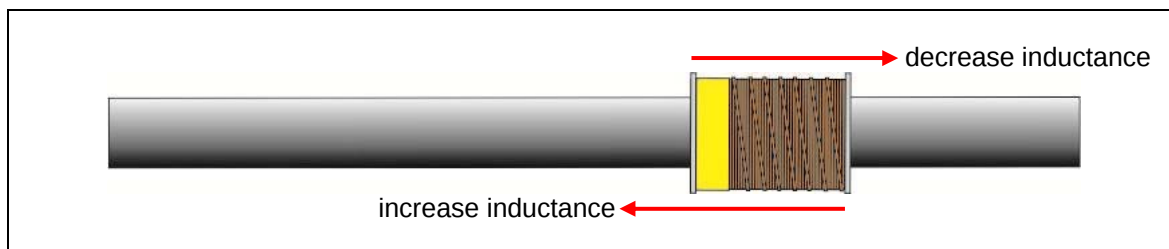
There are two references for indicating that the antenna tuning is okay:

1. Maximum possible voltage
2. The small peak on the sine wave is exactly at the top and the bottom of the curve.

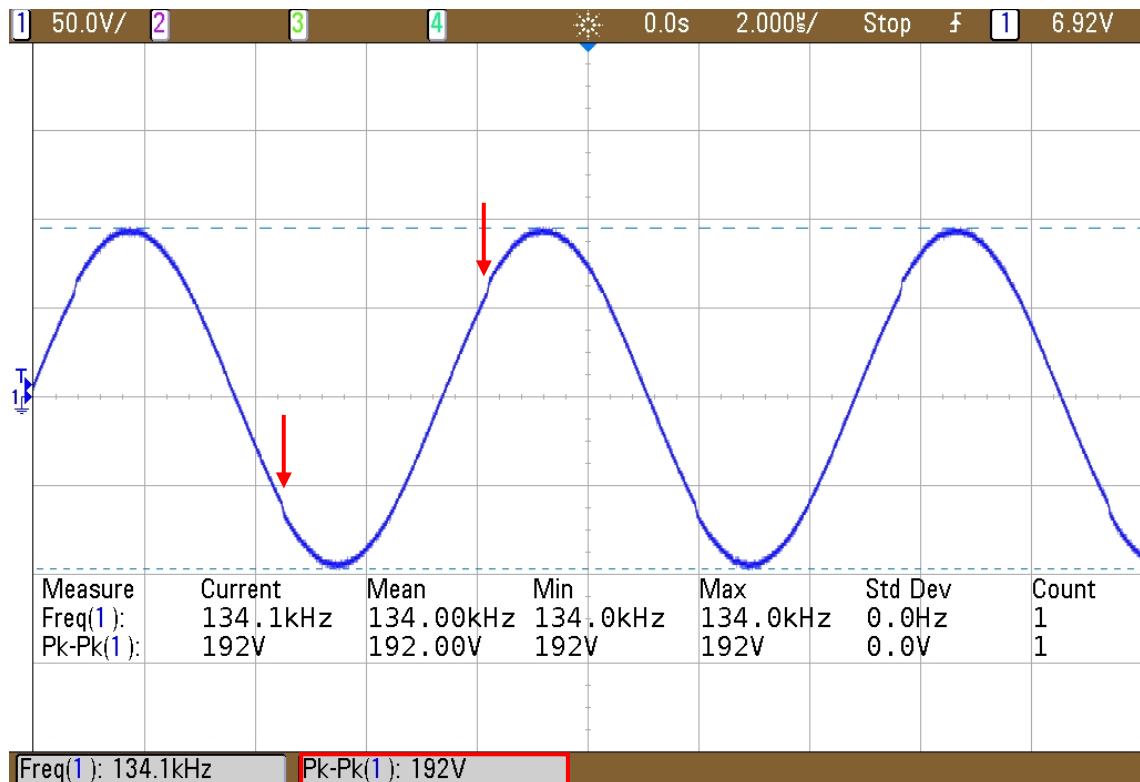
Example for an antenna, where the inductance is too low:



In that example the antenna inductance is too low and the coil is too much at the top of the ferrite (voltage too low and peak more to the right). Move the coil more to the middle of the ferrite. In case of air-coils or casted ferrite antennas, add capacitance.



Example for an antenna, where the inductance is too high:



In that example the antenna inductance is too high and the coil is too much to the middle of the ferrite (voltage too low and peak more to the left). Move the coil more to the top of the ferrite. In case of air-coils or casted ferrite antennas, remove capacitance on your end. If all your additional capacitance is removed and the inductance is still too high, remove 1 turn (or more turns if necessary) from the antenna coil.

4 Capacitor selection

Because of their smaller size you should use SMD capacitors only. In case of SMD capacitors only NP0 (C0G) types should be used. The rated voltage must be at least 500V. The required capacities depend on the deviation of your antenna inductance from the target inductance (275µH). This can be calculated fairly easy using the formula for the resonant frequency.

5 Trouble shooting

For any problem please contact us:

Agrident GmbH
Steinklippenstr. 10
30890 Barsinghausen
Germany

Telephone +49 5105 582573-10
FAX +49 5105 582573-17

Mail: support@agrident.com