

# Field Study News

## WaterResistant solutions

Phonak M H2O and Naída S CRT

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### Summary

The new IP67 rated WaterResistant housing of the Phonak M H2O and Naída S CRT products was tested in regards to reliability in an 11 week validation trial. Overall, 40 subjects wore devices in various demanding situations, stressing them even beyond typical use. All participating subjects received a list of activities with suggested use cases, for example jogging, showering, physically demanding work or activity in dusty environments. For each of these activities experienced with the devices, a questionnaire was completed. The reliability of all devices and all documented activities were closely monitored.

This Field Study News covers the statistical results of the trial as well as the noteworthy case studies of two subjects who wore Naída S CRT while barefoot waterskiing and hiking in a forest in Sweden.

Statistical results show that mechanical reliability was proven in all cases with a minimum effort of troubleshooting required in some. Temporary malfunctions that could not be resolved by using the troubleshooting guide occurred in only 1 of 259 documented activities. The two case studies give some insight into the benefits of the new Phonak WaterResistant devices.

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### Introduction

Building hearing instruments that are resistant to water, sweat and dirt is a challenge. Solutions to protect the sensitive electronics of the hearing instruments must be created and combined to achieve reliable ingress protection. Therefore in a range of new Phonak products, three aspects were optimized in regards to water and dirt/dust particle resistance: the housing design, the materials used and nano-coating. By applying these aspects, the new Phonak H2O housing was IP67 certified by an independent institute. This means the instruments are not damaged beyond repair after 8 hours in a dust chamber, or after being immersed in 1 meter (3 feet) of water for 30 minutes (as defined by IEC60529).

But what does this mean in real life? An appropriate housing design has to take into account two aspects when considering hearing instrument use in or around water. First of all, the common zinc-air battery needs a constant inflow of oxygen to maintain its voltage. If this inflow is interrupted, the battery will stop working after 5 to 10 minutes. Therefore submerging a hearing instrument in liquid longer than this time will result in it no longer functioning due simply to the battery. Additionally, high temperatures or humidity can also have a negative influence on the battery.

The second issue can occur especially with open domes or large vents, when water enters the ear canal and blocks the sound exit. For this study, these two issues were not rated as a technical malfunction of the device, as they are outside the range of influence of the mechanical design.

The goal of this explorative study was to investigate the reliability of the WaterResistant housing. This included an assessment during specific activities listed as potential use cases provided to the test subjects. This study also explored the long term effects of water, sweat and dust on the devices.

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### Method

The study was conducted at Phonak in Stäfa, Switzerland over a period of 11 weeks. Client questionnaires were used to document and collect all reports about all cases in which devices came in contact with water, sweat or dust.

Before the trial, all subjects received a list of potential activities and situations such as showering, sports, dusty environments, wellness spa visits or rain). The only activity that was excluded was swimming with the head under water.

Subjects were instructed to check the devices (for moisture inside the battery door, toggle function, loudness and sound quality) prior to the activity, to ensure full instrument functionality and that a potential malfunction did not already exist. Each activity itself had to be

described in detail in the test subject's own words. Additionally, if there were any troubleshooting needs, subjects were asked to give a detailed description of their observations. By using the troubleshooting guide, a structured course of action including how to identify if the sound exit was clogged or if the battery was starved of oxygen, subjects were asked to solve any malfunctions that occurred. Subjects then had to rate if the issue could be solved or if the malfunction persisted.

If no malfunction occurred, subjects had to recheck the devices after the activity. The setup of the study was approved by the cantonal ethics commission Zürich.

## Subjects and devices

A total of 40 test subjects participated in the study and were split into two groups. Subjects with a mild to moderate hearing loss received binaural Phonak Ambra M H2O and subjects with severe hearing losses, binaural Naída S CRT.

Subjects wearing Ambra M H2O were fitted with individual SlimTips or domes as proposed in the Phonak Target 2.0 fitting software. The Naída S CRT subjects were fitted with the new superpower xSP+ receiver, which is built into a custom cShell.

In order to identify rust or other partial damage inside the instrument, all devices used for this study were built with transparent housings. The mechanical housing design for the Phonak M H2O and Naída S CRT is identical with the exception that the Naída S CRT is an external receiver device.

## Results I – Statistical analysis

Since the mechanical housing design for the Phonak M H2O and Naída S CRT is the same, the results for both groups can be considered together. Statistical results for both groups show that in 219 of 259 documented activities, no troubleshooting of the devices was required. In the remaining 40 activities minor troubleshooting was necessary to restore devices to functioning condition (see Figure 1). In 39 of these 40 cases, after ventilating the battery or cleaning the sound exit, the devices were functional.

Activities overall without and with troubleshooting (n = 259)

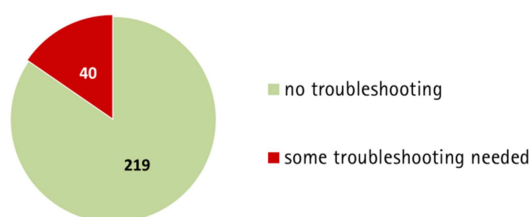


Figure 1: Activities overall with and without troubleshooting (n=259)

Analysis of the documented activities shows that the activities "swimming with head above water" and "wellness (spa)" required the most troubleshooting (see Figure 2).

Activities without and with troubleshooting (n = 259)

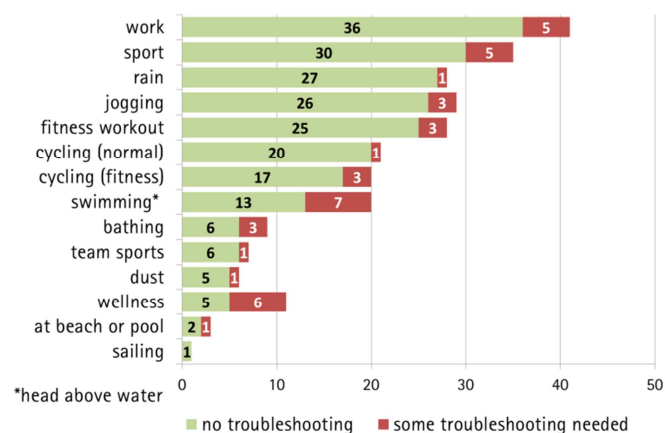


Figure 2: Activities without and with troubleshooting (n=259)

The activity "wellness" included visits to a sauna or steam bath, which are highly negative conditions for zinc-air batteries due to high temperatures or humidity. This leads to insufficient battery voltage and therefore minor troubleshooting was required. After ventilating or changing the battery, all devices functioned again. As stated in the introduction, this battery issue is not related to the housing design, but is an inherent weakness of zinc air batteries.

Overall, the results draw a very positive picture of the WaterResistant housing design in terms of peace of mind when devices accidentally get wet, e.g. under the shower. Subjects enjoyed using the devices during their workouts in the gym, while listening to music streamed via iCom or wearing a helmet while play playing ice hockey.

Overall there was only one case where the device did not function immediately after completing the troubleshooting procedure. However, after the device was dried for some time and a new battery was inserted, it functioned reliably again.

None of the devices showed signs of damage to the electronic parts inside the housing after the 11 week trial but in some cases corroded batteries stained the battery door due to condensation or water in the battery compartment. Regular standard care and maintenance, such as overnight drying of the device can help to prevent this from occurring.

**Case study 1**

This subject tested a pair of Naída S CRT in an exceptional use case situation, which is clearly not recommended. Fitted with cShells and a helix lock, he wore the devices while barefoot water skiing in Florida (see following pictures).



Despite the devices being subjected to high water pressure during four runs of 1 min each, they continued to function. On the fifth run, water entered the battery doors and the devices stopped working. After drying the devices, full functionality was restored.

**Case study 2**

The subject in the second case study wore the devices during a visit to a forest in Sweden. The increased reliability gave great peace of mind and the Naída S CRT remained in the ear while fishing and swimming in white water rivers (see picture above) and cutting down trees during heavy rainy days. The subject emphasized that the ability to hear the full sounds of nature the whole time was stunning and the devices exceeded expectations in terms of audibility and reliability.



This validation study tested the Phonak M H2O and Naída S CRT mechanical design. The WaterResistant housings performed reliably in the various use cases and the collected results as well as the case studies show high satisfaction. Some minor troubleshooting for the hearing instruments was required in especially demanding situations.

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