

# Field Study News

## Phonak CROS

A “quantum leap” for people with total unilateral hearing loss

### Abstract

For people with total unilateral hearing loss, complete loss of hearing in one ear and better hearing on the other ear, understanding speech in noisy situations can be a great challenge which is exacerbated by the head shadow effect. There are many systems available which transmit the acoustic information from the unaidable side to the hearing side but most have not been very efficient. A CROS system consists of a CROS transmitter microphone on the unaidable side and a hearing instrument receiver on the side with better hearing. The new Phonak CROS System, based on the new Spice Generation platform and its wireless capability (HiBAN), makes it possible to transmit clear acoustic information without the intrusion of cable connections between transmitter and receiver. Phonak CROS reduces the head shadow effect enabling users to better understand speech from the unaidable side in noisy situations.

20 test subjects took part in a study to investigate speech intelligibility in noise for people with total unilateral hearing loss wearing Phonak CROS. Six of the subjects were experienced CROS users. Objectively recorded measurement results showed a clear improvement in speech intelligibility in noise with Phonak CROS. The subjective data were obtained by means of a client questionnaire, and likewise reflected a high level of satisfaction amongst the test subjects.

### Introduction

The appeal of Phonak CROS lies in robust wireless audio signal transmission from the unaidable ear to the better ear, its esthetically pleasing design, and its ease of use. One great advantage of Phonak CROS, the wireless HiBAN network, makes Phonak CROS compatible with all wireless Phonak Spice hearing instruments. It was important that Phonak CROS overcome the limitations of current CROS systems in terms of size and shape, so that it satisfies the requirements of each individual. People with normal hearing in the better ear (CROS) as well as people with mild to profound hearing loss (BiCROS) will benefit from the wide variety of functions

Phonak CROS offers such as SoundFlow, Real Ear Sound, QuickSync and, for BiCROS fittings only, SoundRecover. This makes Phonak CROS a genuine highlight amongst today's CROS systems.

The new Phonak CROS is available as a BTE transmitter in the Audéo S SMART housing. It can be placed on the ear either with the specially designed Phonak CROS Retention, or with the customized Phonak CROS Tip to comfortably fit the individual contours of the ear. The CROS transmitter is also available as an custom shell option (ITC, half-shell and full-shell).

The different CROS transmitter styles are shown in Figure 1.



Fig. 1: Illustration of the Phonak CROS BTE and ITE transmitter options. Due to its high degree of flexibility, Phonak CROS can be combined with any type of Spice hearing instruments.

### Aim of the study

The aim was to determine whether there is a clear improvement in speech intelligibility in noise for people with a total unilateral hearing loss when using Phonak CROS.

### Method

To determine the speech intelligibility, the Oldenburg sentence test (OLSA) was carried out. The speech intelligibility was ascertained through adaptive measurement of the speech reception threshold (SRT, signal-to-noise ratio (SNR) at 50% speech intelligibility). The noise used was a speech-

simulating noise. The test subject was rotated in a circle of 12 loudspeakers, once in the direction of the 90° or 270° loudspeaker (*seating position 1; simulating conversation partner at the side*), and then in the direction of the 60° or 300° loudspeaker (*seating position 2; simulating conversation partner obliquely in front*), so that in each case he was seated with the unaidable side toward the 0° loudspeaker. The speech signal produced was always presented from 0°. The noise was played for *seating position 1* from 60°, 120°, 180°, 240° and 300° and for *seating position 2* from 60° or 300°, 120°, 180° and 240°. The measurements were taken using the "Speech in Noise" hearing program, with the BTE CROS transmitter set to the microphone mode "Real Ear Sound", and the ITE CROS transmitter set to the "Omnidirectional" microphone mode. For the BTE measurements, the subjects wore Audéo S SMART IX hearing instruments in the better ear. The OLSA test was carried out with CROS subjects with and without the Phonak CROS System (Phonak CROS plus a Spice hearing instrument). The BiCROS were taken with just the BTE receiver and then with the complete system. The subjective data were collected by means of client questionnaires, which were completed at home during the test phase.

## Test subjects and hearing systems

A total of 20 test subjects took part in this study, six of whom were already experienced users of CROS devices. Both BTE and ITE CROS systems were tested. The first part to the validation investigated the Phonak CROS BTE. 14 subjects were fitted with Audéo S SMART IX to their better ear and five subjects had Phonak Cassia BTE or Phonak Solana BTE fitted to their better ear. After completion of the BTE validation, six BiCROS subjects were fitted Phonak CROS ITE transmitter and Phonak Ambra 312 UZ ITE as the receiver instrument. All the subjects tested the Phonak CROS System in the laboratory and in everyday life situations.

## Results

The averaged measurement results from the OLSA test showed a clear improvement in the intelligibility of speech in noise with the Phonak CROS System. For seating position 1, a SNR improvement of 3.4 dB was achieved with the Phonak CROS System, and for seating position 2 an improvement of 2.5 dB was achieved in comparison to only the receiver microphone situation. It was possible to demonstrate that both CROS and BiCROS subjects clearly benefited from Phonak CROS. The results presented here relate to the BiCROS subjects fitted with BTE and ITE devices. The measurement results for the BTE BiCROS are shown in Figure 2.

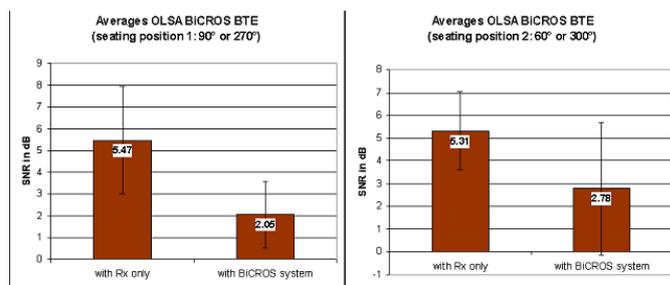


Fig. 2: The averaged measurement data (N = 9) show a clear improvement in the SNR with the Phonak CROS BTE system for both seating positions. The lower the measured values the better the speech intelligibility result. The additional benefit of the Phonak CROS transmitter to wearing a receiver hearing instrument can be clearly demonstrated.

The measurement results for the BiCROS subjects fitted with ITE devices (Fig. 3) also show the improvements similar the BTE devices. Seating position 1 showed a SNR improvement of 4.7 dB and a 5 dB SNR improvement for seating position 2.

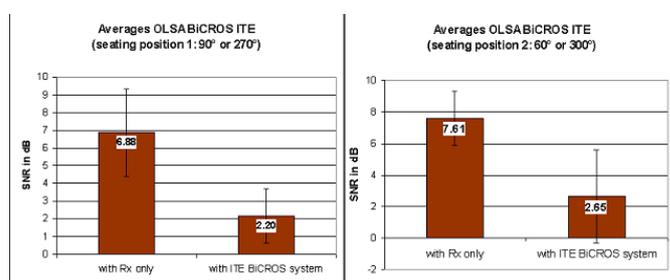


Fig. 3: The averaged measurement data for the ITE BiCROS subjects (N = 6) show a clear improvement in speech intelligibility with the Phonak CROS system in both seating positions. The lower the measured values the better the speech intelligibility result.

For the CROS test subjects, good results were similarly achieved for the same seating positions (data not shown).

The effect of the head shadow can thus be attenuated through the use of Phonak CROS, meaning that improved speech intelligibility from the unaidable side in noisy situations is once again possible. It is well known that the head shadow effect influences not only the intelligibility of speech in noisy situations, but also the sound that is perceived. A brighter sound impression arises from the unaidable side, since high frequencies, which are harder to bend around the head, are now compensated with the CROS system. The subjects describe the altered sound impression as a way to determine the location of sound sources, and did not find it irritating. This is clearly an additional benefit of the Phonak CROS transmitter over a conventional unilateral hearing instrument solution.

In the client questionnaires, the sound quality of the Phonak CROS System was rated as pleasant and natural by 80% of all subjects. This illustrates the good sound quality of Phonak CROS.

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## Conclusions

The new Phonak CROS System clearly demonstrated that people with total unilateral hearing loss will perceive better speech understanding in noisy situations from the unaidable side. This is possible through the stable, wireless broadband audio signal transmission from Phonak CROS to the Spice hearing instrument receiver, in real time, with outstanding sound quality.

Phonak CROS is a "quantum leap" in the treatment of total unilateral hearing loss, with the most cosmetically appealing design since the invention of the CROS systems.

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## References

H. Ericson et al. (1988), Contralateral Routing of Signals in unilateral hearing impairment – A better method of fitting, Scand. Audiol. 17, p: 111 -116

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