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Only quality controlled loops are fit for the future. The new international standard IEC 60118-4 for Audio-Frequency Induction Loop Systems

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Slide 1 (*Only quality...*): Good morning and thank you to the program committee for letting me present this paper to you today.

Slide 2 (*Increasing Signal...*): Even with the perfect algorithm of the hearing aid or the smartest coding strategy in the speech processor of the cochlear implant, there is a need for assistive listening devices when there is reverberation, a long distance-to-the-sound source, or ambient noise. Then the signal-to-noise ratio has to be increased.

Slide 3 (*No noise through echos...*): In this slide Heinz Nafzger shows what happens when the pastor talks from the pulpit and there is no induction loop for people with hearing loss.

Slide 4 (*No transmission time...*): In addition to the problem of reverberation there is the problem of transmission time postponement.

Slide 5 (*No ambient noise*) Every person with a hearing loss knows how difficult it is to understand speech when there is ambient noise (cocktail party)

Slide 6 (*Assistive Listening Systems*) In rooms with difficult room acoustics there is a need for Assistive Listening Systems. There are three different systems: Induction loop, Infrared and Frequency Modulation (FM).

In my paper I will concentrate on induction loop systems because, in my opinion, it is still the best and cheapest technology for fixed installations. An induction loop should be installed in all public buildings such as theaters, school auditoriums, houses of worship.

Slide 7 (*IEC standard...*) The International Electrotechnical Commission in Geneva set up a standard for induction loops in 1981 (IEC 118-4). The exact name is: Methods of measurement of electro-acoustical characteristics of hearing aids. Part 4: Magnetic field strength in audio-frequency induction loops for hearing aid purposes. This standard was amended in 1998 and is now called IEC 60118-4: 1998. This is the international standard which has to be met at the present time. Four different measurements have to be made: 1) Average field strength, 2) Maximum field strength 3) Frequency response 4) Background noise (Magnetic Interference) level. I would guess that 90% of installed induction loops do not meet this standard and therefore give a bad signal which makes it difficult for people with hearing loss even when they switch their hearing aid or cochlear implant to the position "T".

This IEC standard was amended in 2004 by the commission (David Norman is the Swiss representative in the commission). There is now a draft version which was published in November 2004. This new standard, which is not yet approved, mainly explains the measuring procedures and will be a big help to setting state of the art induction loops.

Slide 8 (*Casinotheater The Audio Frequency*): Here you see the Casino Theater in Winterthur / Switzerland. This building was completely renovated in 2002. It is a very positive example because it has a new loop system which meets exactly the standard set up by the International Electrotechnical Commission in 1998.

Slide 9 (*The speech banana*) I will now show you why the frequency response of the induction loop is so important for speech intelligibility. Here you see a graph showing the so-called speech banana. Our speech consists of vowels and consonants. The vowels (o,a,ah,i,e) have low frequencies. The consonants (d,t,s,f,sch) are in the high frequencies. Especially important are the sibilants and the plosives.

Slide 10 (*Korrektur mit Hörgerät...*) Here you can see how a modern multi-channel hearing aid corrects the hearing loss. Speech again becomes intelligible.

Slide 11 (*Correct Frequency Response*) This slide shows the frequency response of an induction loop system which meets the IEC standard. The graph is from the Casino Theater Winterthur.

According to the IEC standard the frequency response has to be measured between the frequencies 100 Hz to 5000 Hz (red line). The tolerance allowed is +/- 3 dB. You can see that this induction loop is exactly within the tolerance. This means a perfect speech signal for hard of hearing people (come to the Casinotheater in Winterthur!)

Slide 12 (*Bedeutung des Frequenzgangs...*) In the last slide you saw a linear frequency response even in the high frequencies. This slide shows what an induction loop not meeting the IEC standard means for people with hearing loss (blue line). If the frequency response is so bad you lose the advantage of the induction loop again. I imagine that most of the existing induction loops have a frequency response like this!

Slide 13 (*Heinz Nafzger ...*) Switzerland passed a new law effective January 1, 2004 which requires all new and newly renovated public buildings to have assistive listening devices for hearing impaired people. The Swiss government gave The Swiss Hard of Hearing Union (now called Pro Audito Schweiz) the right to lodge a complaint or to go to court if buildings are not planned to be "hearing-aid accessible". Pro Audito Schweiz is at present training and certifying professionals who will be capable of measuring induction loops according to the IEC standard.

Slide 14 (*Measuring equipment...*) This slide shows the measuring equipment you need for testing the IEC standard.

Slide 15 (*An instruction manual...*) text on slide

Slide 16 (*The Swiss Team Alinghi...*) For the famous sailing competition "America's cup", Phonak designed an induction loop system on the Swiss Alinghi yacht. I quote from the Phonak Press Release (March 8, 2003): "The high-tech hearing instruments worn by each crewmember, received the commands with perfect sound quality, eliminating all potential distractions from wind, waves and helicopters."

Slide 17. (*Cochlear implants are ready*) Cochlear implants are ready for induction loops either with integrated T-coils or T-coils as accessories.

Slide 18 (*Induction loops or FM in schools?*) text on slide

Slide 19 (Thank...) Thank you for your attention