DELTA Test Report

Acoustic Test Report according to IEC 60118-0, 1, 2, 6 on
Epoq XW manufactured by Oticon
Name and type Oticon Epoq XW
Serial number # 15768593
General description BTE
Report number PR079_10
Number of pages 17
Client DELTA TAL
Edisonsvej 24
5000 Odense
Danmark
Contact Person LFN
Reception date 26-03-2010
Test date 05-05-2010
Climatic conditions Temperature : 22°C
Barometric pressure : 101 kPa
Humidity : 40 %
Test methods IEC 60118 - 0, 1, 2, 6 & DQP-86001
Software version TAL HM 5.0.5
Test program version TAL008
Co-Reader CVJ
Test personnel LFN

Responsible
Lars F. Nielsen
M.Sc.E.E.
DELTA Danish Electronic, Light & Acoustics
Technical-Audiological Lab.

The present report describes results of measurements on hearing instruments, identified by name, type and serial number.
The laboratory can not guarantee, that these data applies on the entire production.
Electro Acoustical Properties

Climatic requirements
The climate in the testing laboratory is registered. The IEC 60118-0 standard states the following requirements which were fulfilled during test (see page 2):

Temperature: 23 ± 5°C
Air pressure: 101.3 +5/-20 kPa
Humidity: 40 - 80 %

Test setup
The measurements are carried out in a free field, in accordance with IEC 60118-0 substitution method. The test object is connected to the Ear Simulator (IEC 60318-4) using tubing with dimension Ø2 x 25 mm. The loudspeaker and the test object are placed in an anechoic chamber 1.2 metres above the grating floor 0.8 metres apart.

Hearing aid adjustments and list of accessories
The hearing aid is programmed to deliver unity gain.

Measurements
Reference test frequency is 1600 Hz.
All sound pressures are expressed in dB relative 20 µPa.

Uncertainties
Frequency: ± 0.5 %
Current: ± 0.5 %
Sound Pressure Level, 200 Hz - 4000 Hz: ± 1.5 dB
Sound Pressure Level, 4000 Hz - 8000 Hz: ± 1.9 dB
The uncertainty primarily due to tolerances on the control microphone and the IEC 60318-4 coupler.
Attack time: ± 1.1 ms The uncertainty primarily due to “slew rate” on the loudspeaker.
Recovery time: ± 10 ms The uncertainty primarily due to Test system.
DATA (Primary results)

Maximum output : 101 dB SPL at 3981 Hz
Maximum acoustic gain : 15 dB at 3019 Hz
Reference test gain : 7 dB at 1600 Hz

Reference measurements

# 15768593

OSPL90 (dB SPL)
Maximum 101
1600 Hz 95

Unity gain (dB)
Maximum 15
1600 Hz 7

Reference measurement are made on 1 hearing instruments, identified by the serial number stated in the table above (marked by *).
**IEC 60118-0.7.2 : Output sound pressure level response, OSPL90**

HA adjustment: Unity gain.

Input = 90 dB SPL.

Frequency response of the sound pressure level obtained in the ear simulator using an input of 90 dB SPL.
**IEC 60118-0.7.3 : Full-on acoustic gain**

HA adjustment: Unity gain.

Input = 50 dB SPL.

Measurement of full-on acoustic gain obtainable with the hearing aid.
IEC 60118-0.7.4 : Comprehensive frequency response

HA adjustment: Unity gain.

Input = 40, 50, 60, 70, 80 and 90 dB SPL.

The curve for 60 dB SPL input is the ‘Basic frequency response’.

Reference test gain = 7 dB.
IEC 60118-0.7.12.1: Measurement of nonlinearities (harmonic distortion)

HA adjustment: Unity gain.

Input = 60 dB SPL.

Measurement of amplitude nonlinearities in the hearing instrument 2nd order (Black), 2nd & 3rd order (Red). Harmonic distortion is measured by means of Test system with a frequency resolution of 10 points per octave.

Conversion between dB and % THD

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HA adjustment: Unity gain.

Input = 70 dB SPL.

Measurement of amplitude nonlinearities in the hearing instrument 2nd order (Black), 2nd & 3rd order (Red). Harmonic distortion is measured by means of Test system with a frequency resolution of 10 points per octave.

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**IEC 60118-0.7.12.1 : Measurement of nonlinearities (harmonic distortion)**

HA adjustment: Unity gain.

Input = 65, 90 dB SPL.

Measurement of amplitude nonlinearities in the hearing instrument THD input=90 dB SPL (Black), THD input=65 dB SPL (Red). Harmonic distortion is measured by means of Test system with a frequency resolution of 10 points per octave.

**Conversion between dB and % THD**

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IEC 60118-0.7.12.2 : Measurement of nonlinearities (intermodulation distortion)

HA adjustment: Unity gain.

Input = 2 x 54 dB SPL.

Measurement of amplitude nonlinearities in the hearing aid. Intermodulation products of 2nd order (Black) and 3rd order (Red), relative to the level of the fundamental tone. F2 = F1+125 Hz. Distortion is measured by means of Test system with a frequency resolution of 10 points per octave.

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**IEC 60118-0.7.12.2 : Measurement of nonlinearities (intermodulation distortion)**

HA adjustment: Unity gain.

Input = 2 x 64 dB SPL.

Measurement of amplitude nonlinearities in the hearing aid. Intermodulation products of 2nd order (Black) and 3rd order (Red), relative to the level of the fundamental tone. \( F_2 = F_1 + 125 \text{ Hz} \). Distortion is measured by means of Test system with a frequency resolution of 10 points per octave.

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**IEC 60118-0.7.14.1 : Internal noise generated in the hearing instrument (1/3 octave)**

HA adjustment: Unity gain.

Input = 50 dB SPL.

The purpose of the measurement is to determine the internally generated noise in the hearing aid (input related).
**IEC 60118-2.5.1 : Steady-state input/output graph (AGC systems)**

HA adjustment: Unity gain.

Test frequency = 1600 Hz.

Measurement of the relation between input sound pressure level and output sound pressure level.
IEC 60118-2.5.1: Steady-state input/output graph (AGC systems)

HA adjustment: Unity gain.

Test frequency = 1600 Hz.

Measurement of the relation between input sound pressure level and output sound pressure level.
**IEC 60118-2.6.2.1 : Dynamic output characteristics for speech levels**

HA adjustment: Unity gain.

Input = 55 dB - 80 dB (speech level) at 1600 Hz.
Input signal stable for 0.5 seconds prior to level shift.
AGC attack time with speech level signal: < 1 ms.

Input = 80 dB - 55 dB (speech level) at 1600 Hz.
Input signal stable for 0.2 seconds prior to level shift.
AGC recovery time with speech level signal: 0.007 s.
Measurement of the hearing aid attack and recovery time.
**IEC 60118-2.6.2.2 : Dynamic output characteristics for high level input**

HA adjustment: Unity gain.

Input = 60 dB - 100 dB (high level) at 1600 Hz.
Input signal stable for 0.5 seconds prior to level shift.
AGC attack time with high level signal: < 1 ms.

Input = 100 dB - 60 dB (high level) at 1600 Hz.
Input signal stable for 0.2 seconds prior to level shift.
AGC recovery time with high level signal: 0.047 s.
Measurement of the hearing aid attack and recovery time.
DELTA Test Report

Acoustic Test Report according to IEC 60118-0, 1, 2, 6 on Mind 440 M4-m CB manufactured by Widex
The present report describes results of measurements on hearing instruments, identified by name, type and serial number. The laboratory can not guarantee, that these data applies on the entire production.
Electro Acoustical Properties

Climatic requirements
The climate in the testing laboratory is registered. The IEC 60118-0 standard states the following requirements which were fulfilled during test (see page 2):
Temperature: 23 ± 5°C
Air pressure: 101.3 ±5/-20 kPa
Humidity: 40 - 80 %

Test setup
The measurements are carried out in a free field, in accordance with IEC 60118-0 substitution method. The test object is connected to the Ear Simulator (IEC 60318-4) using tubing with dimension Ø2 x 25 mm. The loudspeaker and the test object are placed in an anechoic chamber 1.2 metres above the grating floor 0.8 metres apart.

Hearing aid adjustments and list of accessories
The hearing aid is programmed to deliver unity gain.

Measurements
Reference test frequency is 1600 Hz.
All sound pressures are expressed in dB relative 20 µPa.

Uncertainties
Frequency: ± 0.5 %
Current: ± 0.5 %
Sound Pressure Level, 200 Hz - 4000 Hz: ± 1.5 dB
Sound Pressure Level, 4000 Hz - 8000 Hz: ± 1.9 dB
The uncertainty primarily due to tolerances on the control microphone and the IEC 60318-4 coupler.
Attack time: ± 1.1 ms The uncertainty primarily due to “slew rate” on the loudspeaker.
Recovery time : ± 10 ms The uncertainty primarily due to Test system.
**DATA (Primary results)**

Maximum output : 105 dB SPL at 2897 Hz  
Maximum acoustic gain : 16 dB at 2897 Hz  
Reference test gain : 7 dB at 1600 Hz

**Reference measurements**

# 032884

OSPL90 (dB SPL)  
Maximum 105  
1600 Hz 96

Unity gain (dB)  
Maximum 16  
1600 Hz 7
IEC 60118-0.7.2 : Output sound pressure level response, OSPL90

HA adjustment: Unity gain.

Input = 90 dB SPL.

Frequency response of the sound pressure level obtained in the ear simulator using an input of 90 dB SPL.
**IEC 60118-0.7.3 : Full-on acoustic gain**

HA adjustment: Unity gain.

Input = 50 dB SPL.

Measurement of full-on acoustic gain obtainable with the hearing aid.
**IEC 60118-0.7.4 : Comprehensive frequency response**

HA adjustment: Unity gain.

Input = 40, 50, 60, 70, 80 and 90 dB SPL.

The curve for 60 dB SPL input is the ‘Basic frequency response’.

Reference test gain = 7 dB.
**IEC 60118-0.7.12.1 : Measurement of nonlinearities (harmonic distortion)**

HA adjustment: Unity gain.

Input = 60 dB SPL.

Measurement of amplitude nonlinearities in the hearing instrument 2nd order (Black), 2nd & 3rd order (Red). Harmonic distortion is measured by means of Test system with a frequency resolution of 10 points per octave.

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IEC 60118-0.7.12.1: Measurement of nonlinearities (harmonic distortion)

HA adjustment: Unity gain.

Input = 70 dB SPL.

Measurement of amplitude nonlinearities in the hearing instrument 2nd order (Black), 2nd & 3rd order (Red). Harmonic distortion is measured by means of Test system with a frequency resolution of 10 points per octave.

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HA adjustment: Unity gain.

Input = 65, 90 dB SPL.

Measurement of amplitude nonlinearities in the hearing instrument THD input=90 dB SPL (Black), THD input=65 dB SPL (Red). Harmonic distortion is measured by means of Test system with a frequency resolution of 10 points per octave.

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**IEC 60118-0.7.12.2 : Measurement of nonlinearities (intermodulation distortion)**

HA adjustment: Unity gain.

Input = 2 x 54 dB SPL.

Measurement of amplitude nonlinearities in the hearing aid. Intermodulation products of 2nd order (Black) and 3rd order (Red), relative to the level of the fundamental tone. F2 = F1+125 Hz. Distortion is measured by means of Test system with a frequency resolution of 10 points per octave.

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HA adjustment: Unity gain.

Input = 2 x 64 dB SPL.

Measurement of amplitude nonlinearities in the hearing aid. Intermodulation products of 2nd order (Black) and 3rd order (Red), relative to the level of the fundamental tone. F2 = F1 + 125 Hz. Distortion is measured by means of Test system with a frequency resolution of 10 points per octave.

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Input = 50 dB SPL.

The purpose of the measurement is to determine the internally generated noise in the hearing aid (input related).
HA adjustment: Unity gain.

Test frequency = 1600 Hz.

Measurement of the relation between input sound pressure level and output sound pressure level.
**IEC 60118-2.5.1: Steady-state input/output graph (AGC systems)**

HA adjustment: Unity gain.

Test frequency = 1600 Hz.

Measurement of the relation between input sound pressure level and output sound pressure level.
IEC 60118-2.6.2.1: Dynamic output characteristics for speech levels

HA adjustment: Unity gain.

Input = 55 dB - 80 dB (speech level) at 1600 Hz.
Input signal stable for 0.5 seconds prior to level shift.
AGC attack time with speech level signal: < 1 ms.

Input = 80 dB - 55 dB (speech level) at 1600 Hz.
Input signal stable for 0.2 seconds prior to level shift.
AGC recovery time with speech level signal: 0.008 s.
Measurement of the hearing aid attack and recovery time.
IEC 60118-2.6.2.2: Dynamic output characteristics for high level input

HA adjustment: Unity gain.

- Input = 60 dB - 100 dB (high level) at 1600 Hz.
  - Input signal stable for 0.5 seconds prior to level shift.
  - AGC attack time with high level signal: 22 ms.

- Input = 100 dB - 60 dB (high level) at 1600 Hz.
  - Input signal stable for 0.2 seconds prior to level shift.
  - AGC recovery time with high level signal: 0.247 s.
  - Measurement of the hearing aid attack and recovery time.