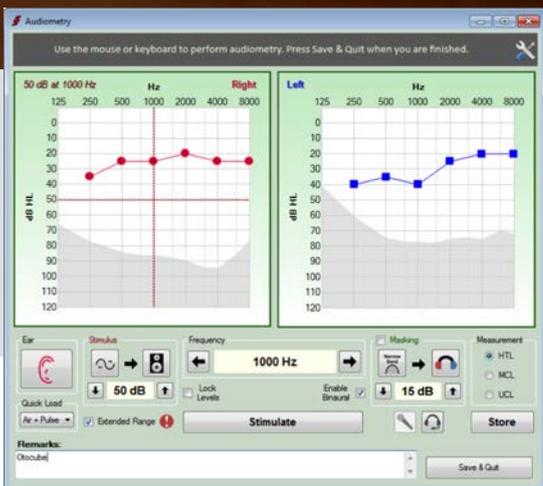
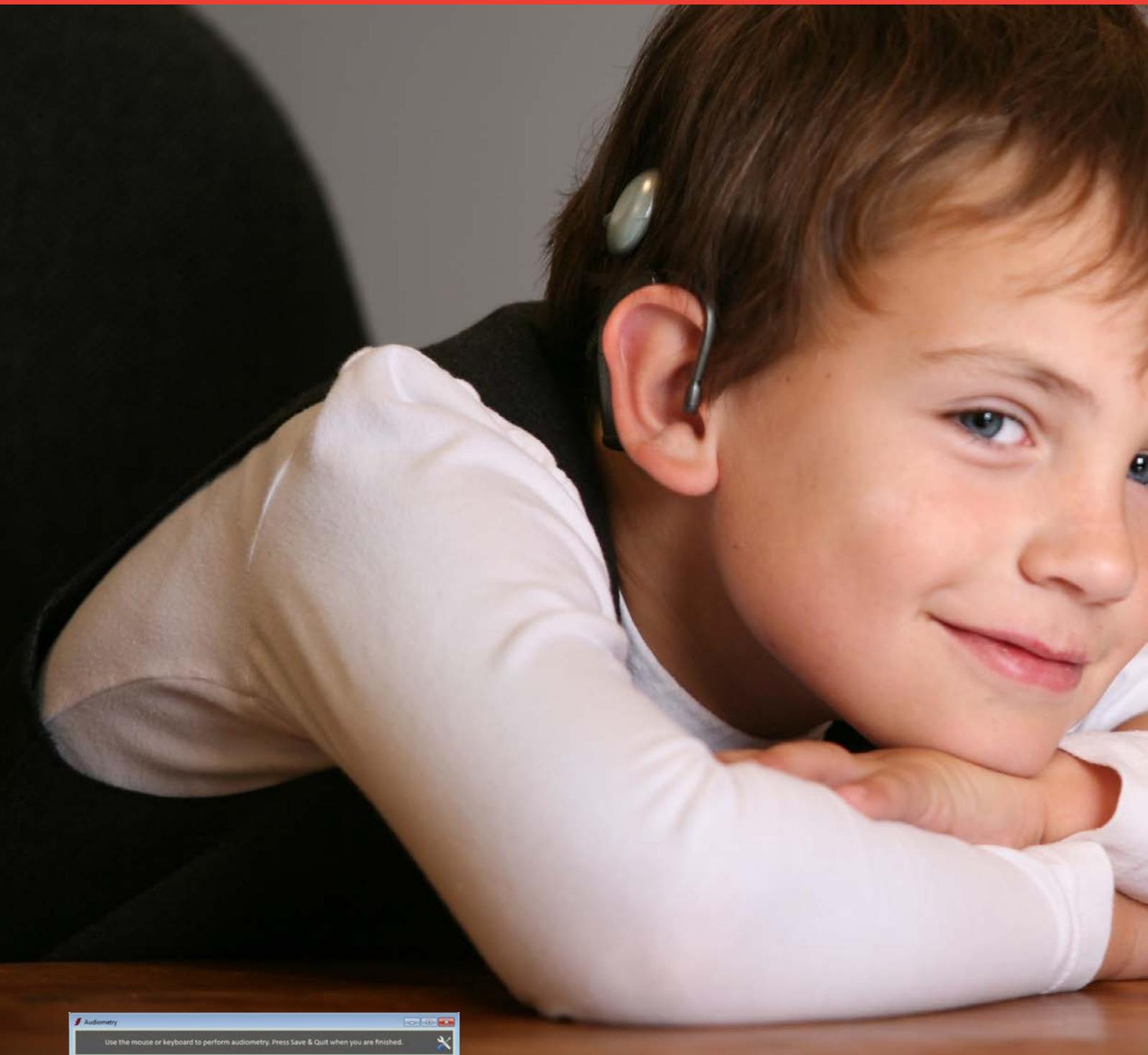


## A revolution in testing and programming of cochlear implants



# No more need for sound-treated rooms



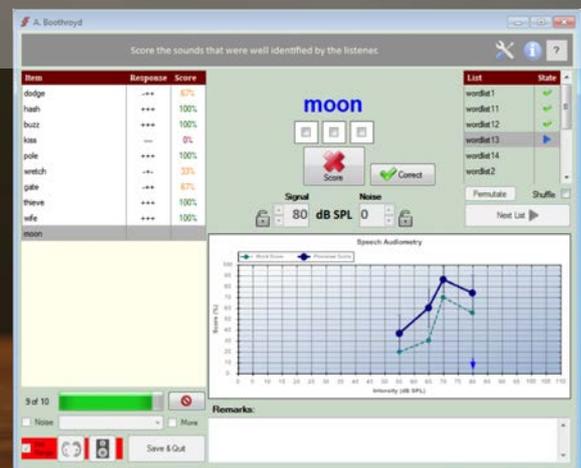
Programming cochlear implants is the art of adjusting the device parameters to optimize the hearing performance of the CI user. Measuring the audiological outcome is an essential step in this procedure. For each CI recipient this needs to be done at regular intervals after the device switch-on. At present this requires sound-treated rooms with high end audiological equipment.

Otocube is a cutting-edge piece of hardware which brings a revolution to the testing and programming of cochlear implants. Otocube is a high-fidelity portable desktop box which replaces a fully equipped audiological room. It outperforms a clinical booth in acoustical insulation and contains the required electronics, a class D amplifier and loudspeaker to deliver well calibrated sound between 15 and 100 dB HL to the CI processor in the box.

This is how it works: Place the CI processor in the slit in the box, close the box and use a long headpiece cable to transfer the signal from the processor to the recipient's implant.

The box easily connects “plug and play” to your laptop or PC and with the audiological software A\$E you readily perform audiometry, speech audiometry in virtually any language, loudness scaling, spectral discrimination, temporal fine structure tests, etc.

The driver and monitor software allows swift verification of the calibration at any moment. Thanks to the built-in class 1 microphone you can listen to the sound in the box and have a real-time graphical representation of its intensity and spectral content on your screen.



# The Box

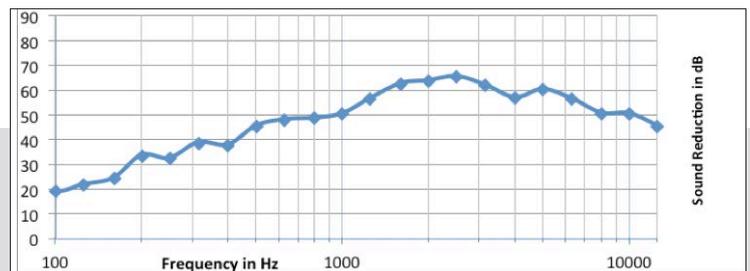


## Technical Data

•	Dimensions 45.7 x 33 x 21,3 cm
•	Weight 15 kg
•	Sound Insulation for ambient noise meets ISO 8253-2 2009 Table II
•	Frequency Range 35 Hz – 16000 Hz
•	Excitation Levels : limited at 120 dB SPL
•	Approximates free-field condition
•	Dynamic Range 10-120 dB SPL (limited)
•	Microphone (optional) 1/2 inch ANSI type 1 (6-12.5 kHz, inherent noise < 16 dB(A))
•	Monitoring Microphone 1/4 inch IEC-61672 (8-12.5kHz, inherent noise)
•	Speaker, high fidelity
•	Sound Card 24 Bits AD converter, 44.1 Hz, (frequency 20 - 20kHz, inherent noise frequency depended typical 15 dB @ 1000 Hz), ICCP powered
•	Self contained Class-D Amplifier 180 Watt, ultrahigh fidelity, flat frequency response irrespective of load impedance, nearly frequency-independent distortion behavior and very low The following items are included in this box: radiated and conducted EMI. Distortion in situ < 0.1% Frequency response 10 – 50 kHz.
•	Power supply class-1 input 80 – 264 VAC. Always connect to earth!
•	Conforms to 2006/95/EC & 2004/108/EC
•	Conforms to specifications described in ISO 8253-2 2009 part 2 and ANSI S3.1-1991

## Attenuation for ambient noise Otocube

The Otocube is a dedicated test booth with a high sound insulation for diffuse ambient sound. Because of its special design and the use of special materials the sound insulation of the Otocube meets or outperforms the large traditional audio logical booths. To meet the ISO standard ISO-8253 the ambient sound level surrounding the Otocube should not exceed 55 dB(A). Typically the ambient noise in a quiet office or CI fitting room will be around 40-45 dB(A).



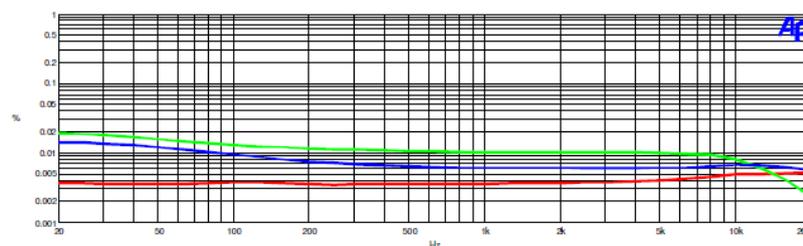
## Monitoring Microphone Otocube

Model	MPA416
Optimized	Free Field
Diameter	1/4 inch
Standards	IEC Class-1
Frequency Response (Hz)	20 ~ 20k
Open-circuit Sensitivity (mV/Pa) ( $\pm 2$ dB)	50
Dynamic Range (dBA)	29~ 127
Inherent Noise (dBA)	< 29
Venting	Rear
Operating Temperature Range ( $^{\circ}$ C)	-10 ~ 50
Operating Humidity Range (RH)	0 ~ 95%
(Without Condensed Water)	
Supply Power	ICCP 2-20mA
Equivalent Air Volume (250 Hz) ( $\text{mm}^3$ )	-
Temperature Coefficient (dB/A)	15-35C
Humidity Coefficient (dB/%RH)	20%-90%
Pressure Coefficient (250 Hz) (dB/kPa)	-0.06
Dimensions	IEC-61672 Class-1
Screw Thread	M11.7 – 60UNS

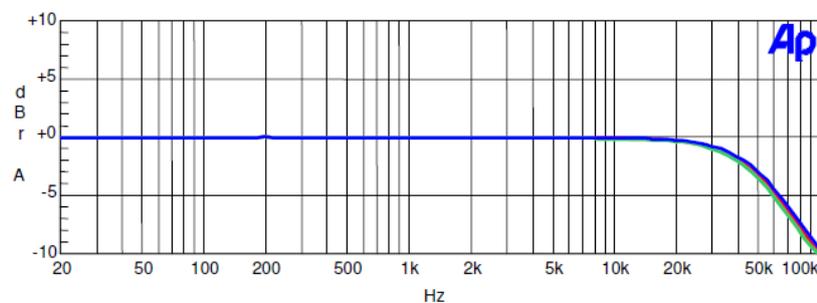
## High efficiency power amplifier OtoCube

The high power high fidelity Class-D amplifier has a flat, fully load independent frequency response with very low frequency independent total harmonic distortion of 0.02% (20Hz-20kHz). The amplifier has an efficiency of 92% at full load. The maximum output power is 180 Watt @ 8 Ohm. On a 8 ohm load, the Class-D amplifier will produce at a listening position of approximately 5 cm the required 120 dB SPL.

**THD vs. Frequency (8Ω)**

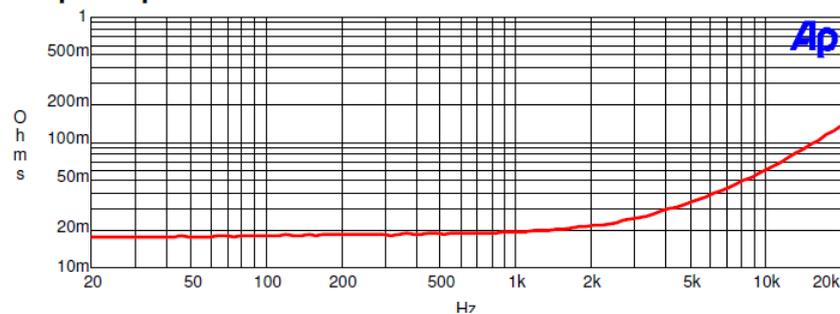


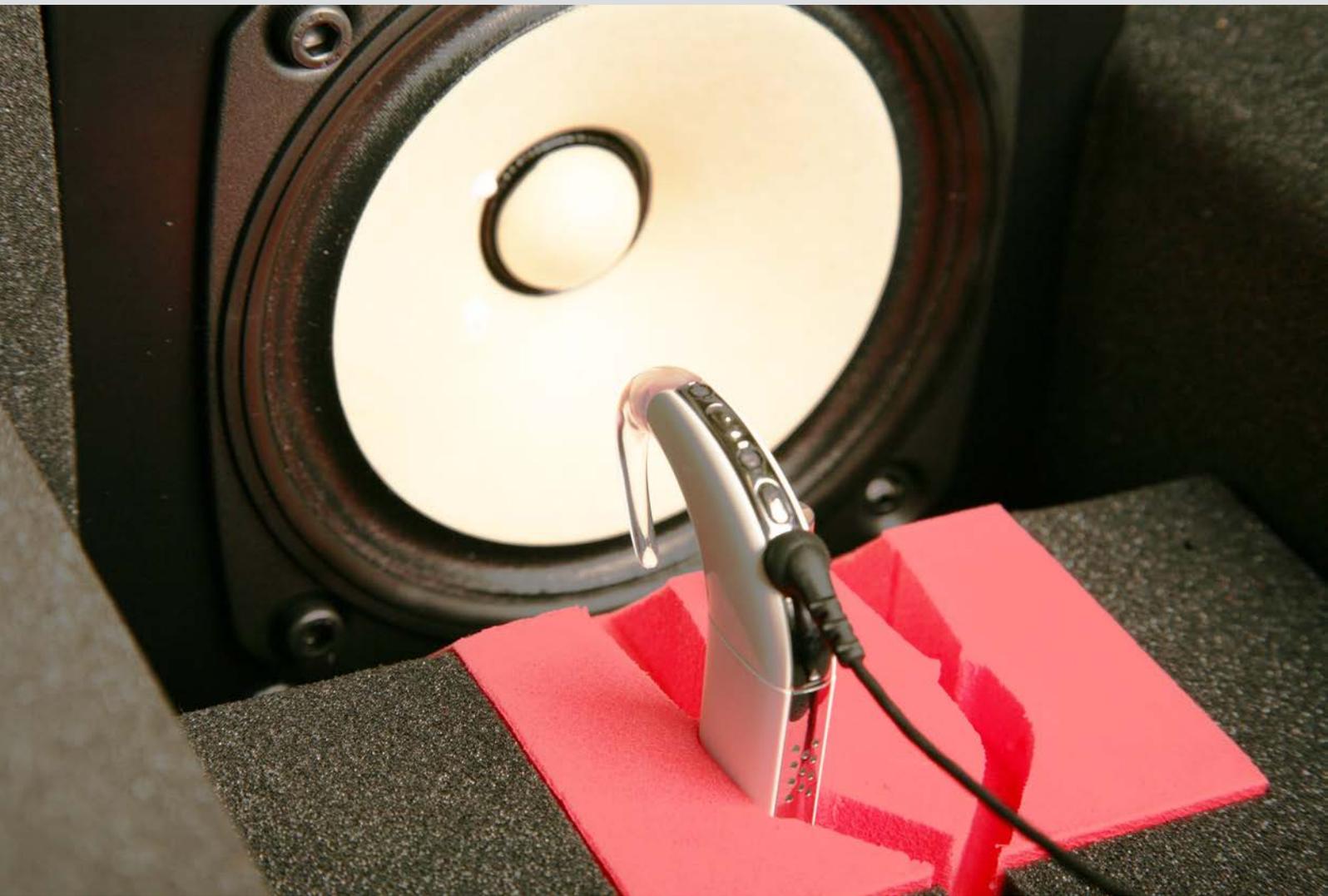
From top to bottom: 40W, 10W, 1W  
Frequency Response (4Ω, 8Ω and open circuit)



From top to bottom: open circuit, 8Ω, 4Ω

**Output Impedance**





## Loudspeaker Otocube

The loudspeaker is a high fidelity speaker with linear behavior for the frequency region that is clinically being assessed, namely 125 to 8000Hz. SO8253-2: 2009 §5.2. The tolerance signal being delivered by a loudspeaker is within the specifications of the ISO regulations. A calibrated box has a linear spectrum within 0,5 dB.

## Compliance

*The Otocube complies with the following standards*

1	ISO	8253-1	Acoustics -- Audiometric test methods -- Part 1: Basic pure tone air and bone conduction threshold audiometry
2	ISO	8253-2	Acoustics -- Audiometric test methods -- Part 2: Sound field audiometry with pure-tone and narrow-band test signals
3	ISO	8253-3	Acoustics -- Audiometric test methods -- Part 3: Speech audiometry
4	ANSI	S3.6-2004	Specification for Audiometers
5	IEC	60645-1	Audiometers - Part 1: Pure-tone audiometers
6	ISO	6189:1983	Acoustics -- Pure tone air conduction threshold audiometry for hearing conservation purposes
7	IEC	60645-2	Audiometers - Part 2: Equipment for Speech Audiometry
8	IEC	60645-3	Audiometers - Part 3: Auditory test signals of short duration for audiometric and neuro-otological purposes
9	IEC	60645-4	Audiometers - Part 4: Equipment for extended High Frequency Audiometry
10	ASHA	10.1044/policy.GL2005-00014	Guidelines for Manual Pure-Tone Threshold Audiometry
11	ASHA	10.1044/policy.GL1988-00008	Determining Threshold Level for Speech
12	ISO	389-4	Part 4: Reference levels for narrow-band masking noise
13	ISO	389-5	Part 5: Reference equivalent threshold sound pressure levels for pure tones in the frequency range 8 kHz to 16 kHz
14	ISO	389-6	Part 6: Reference threshold of hearing for test signals of short duration
15	ISO	389-7	Part 7: Reference threshold of hearing under free-field and diffuse-field listening conditions
26	ISO	389-9	Part 9: Preferred test conditions for the determination of reference hearing threshold levels

## Calibration of the Otocube

Every Otocube is individually calibrated and comes with a digital calibration file which is stored in the memory of the Otocube. This guarantees a flat frequency response of the entire system. The software also comes with a calibration tool. This allows a quick verification of the calibration on a daily basis.



Robust  
Safe  
Flexible and  
Portable

Otocube is housed in a lightweight and rugged Peli™ Case. This case is the result of years of perfecting and testing in both the laboratory and the field. From the proprietary HPX™ plastic resin that is tough during low-temperature impact testing, to the patented Press & Pull latch that opens easily, every facet of these lightweight cases has been created to defend your vital gear. This case has been designed to meet and exceed military testing requirements and it is airline size appropriate (exterior dimensions 48.7 x 38.6 x 22.9 cm).

Otocube fits on any desk. Its weight of about 15 kg makes it portable and easy to transport not just within the clinic but also for visiting patients at home or to move between centers. The medical class-I power supply guarantees maximum safety to you and your patients.



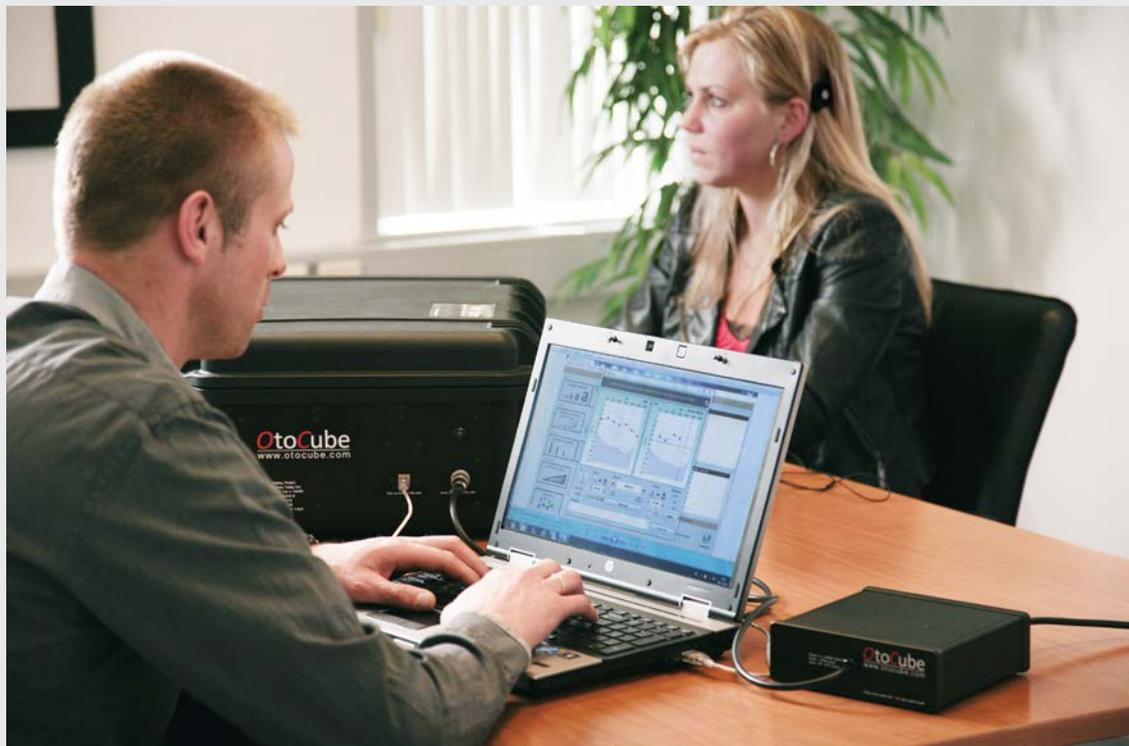
## All audiological tests at your fingertips

A5E diamond is the professional high end plug and play software package which contains all psycho-acoustical tests needed to get an in depth picture of the auditory performance of the CI-recipient.

With A5E and Otocube, audiometry, speech audiometry, spectral discrimination and so many other tests become readily available at your desk.

The built in calibration and monitoring tool allows swift calibration at any moment and real-time analysis of the presented signal in the temporal and the spectral domain.

With the talk-forward feature switched on, the clinician can talk to the patient through the talk forward microphone.





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Otocube is based on an idea of Prof. Dr. Paul J. Govaerts, MD, MSc.  
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