Aria

single channel, portable,

screening and diagnostic

AEP, ASSR, VEMP and OAE

INTELLIGENT HEARING SYSTEMS

many options, one **smart** system

the complete portable solution

Intelligent Hearing Systems is excited to introduce Aria, a cutting-edge, single-channel, auditory evoked potential and otoacoustic emissions device. Aria is designed to embody the hallmark quality and flexibility of IHS, in a portable and cost effective package for screening and diagnostic AEPs, ASSR, VEMP, OAEs, and more...

exceptional design

Over 40 years of engineering and design experience, combined with unsurpassed expertise in evoked responses, have culminated in the **next generation bio-amplifier** to bring you **superior data quality** for evoked potentials and otoacoustic emissions

Reduced test times without compromising data quality

Repeatable, reliable data you can count on

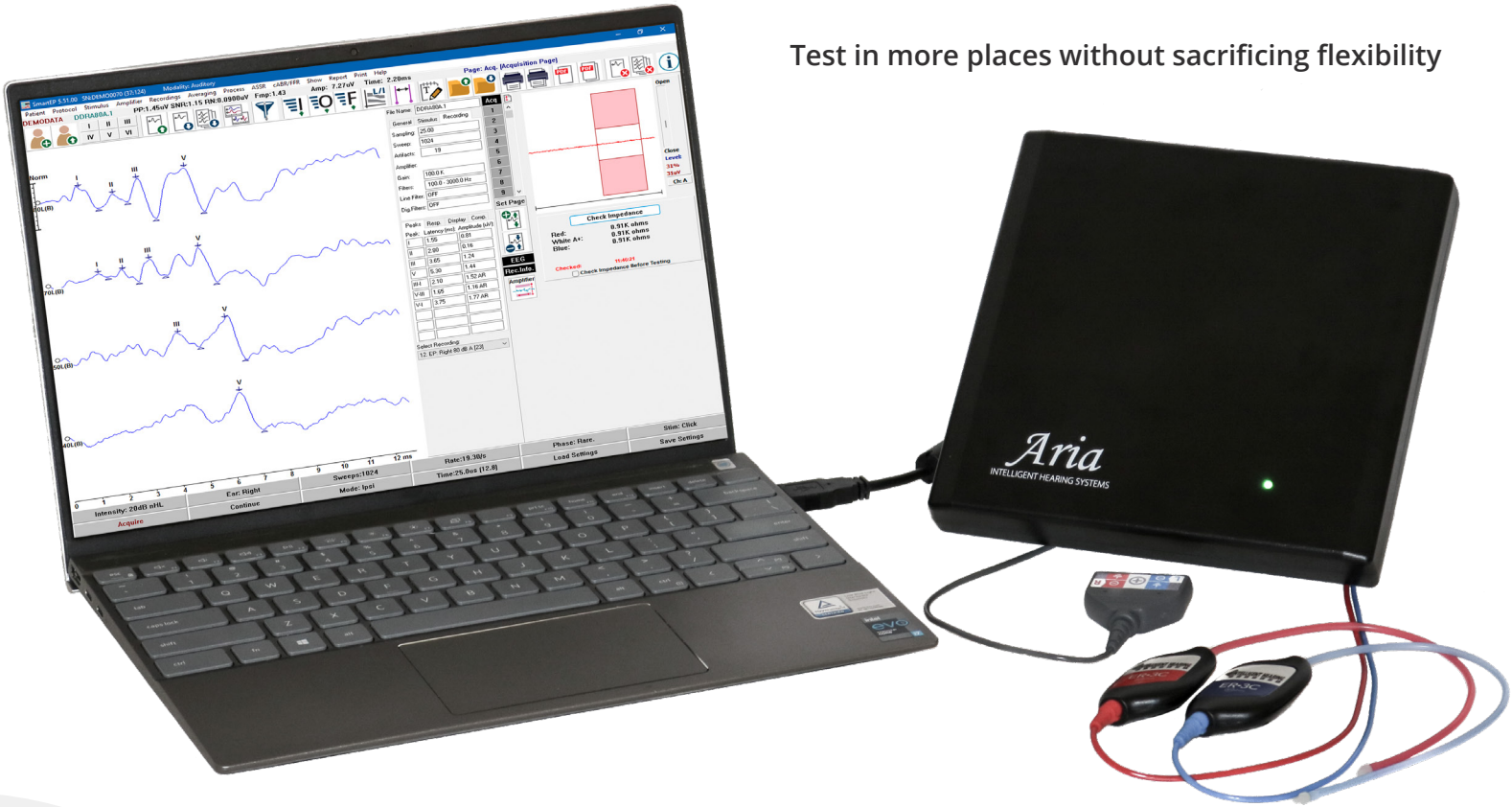
- High definition responses
- Cleaner, more robust responses
- Increased signal-to-noise ratio (SNR)
- Lower residual noise

sleek and compact

The newest member of the IHS device family, Aria is our most portable clinical device providing unparalleled convenience without compromising on performace.

- Ultra light weight, at less than 1 lbs (0.45 kg)
- Single channel EP and/or single channel OAE
- PC USB powered, no need for electrical outlet power
- Built-in isolation: can be used in any location, including the NICU and OR

Test in more places without sacrificing flexibility



designed for an improved clinical experience

ideal for the clinic

Aria is a great tool for recording ABRs and OAEs in clinics wanting a cost-effective 1-channel solution. Aria can also be configured as a standalone automated ABR and/or OAE screener.
The following modules are available on Aria:

Standard SmartEP modules:

- ECochG
- ABR (click, tone burst, iChirp)
- MLR
- LLR/CAEP

Optional SmartEP modules:

- cVEMP, oVEMP
- P300/MMN
- ASSR
- Chained-Stimuli ABR

SmartScreener-Plus 2:

- Automated ABR Screening
- Automated OAE Screening

Audiometry:

- SmartAudiometer
- Intelligent VRA

Standard SmartOAE modules:

- DPOAE
- TEOAE
- SOAE

Add the options that meet your clinic's needs and upgrade at any time.

powerful for research

Advanced options for SmartEP:

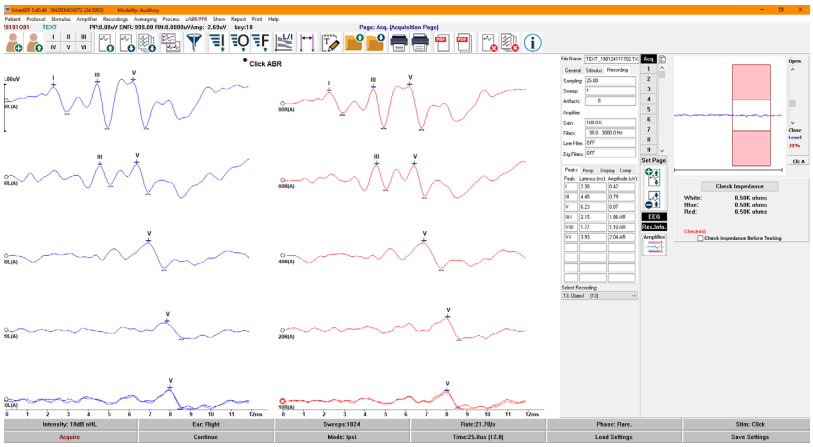
- Advanced Auditory Research Module (AARM)
- Frequency Following Response (FFR)
- Complex ABR (cABR)
- Acoustic Change Complex (ACC)
- Chirp Stimulus Generation Module
- DLL Development Kit

SmartEP

The ideal clinical tool for recording ECochG, ABR, and more.

user friendly interface simplifies acquisition

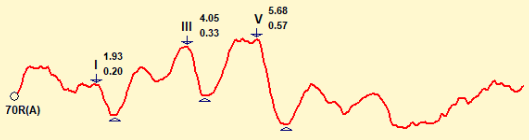
- Easy access to all parameters from a simplified control panel and streamlined menus
- Change most test parameters with a single click
- Single channel system with automatic polarity switching
- Quickly load your own or preset protocols
- Intuitive tool bar and button design for fast access to key features
- Easily view ongoing EEG display for quick assessment of patient state during testing
- Choose from a variety of stimuli, or generate or import your own custom stimuli
- On-screen impedance checking
- Quickly resize the waveforms using the zoom in/out buttons
- Compare any two recordings with automatic latency difference calculation
- Quickly add, subtract, invert, time shift, or cross-correlate recordings



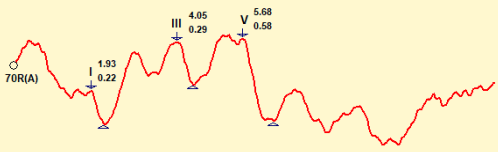
smarter averaging options

- Record using various averaging methods, including Standard, Median, Weighted, Bayesian Weighted, and Smart Average
- Recalculate block averaged recordings using any of the averaging techniques for further noise reduction
- Seamlessly switch between averaging methods during acquisition
- Averaging techniques can be changed post-acquisition with the option to show as a new recording

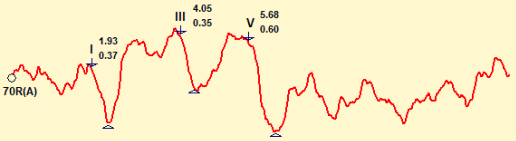
Original Acquisition: patient awake and active



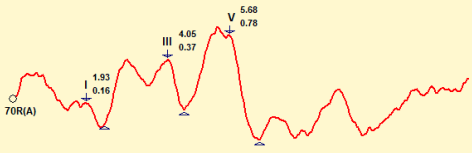
Bayesian Weighted Average



Weighted Average



Median Average



Smart Average™

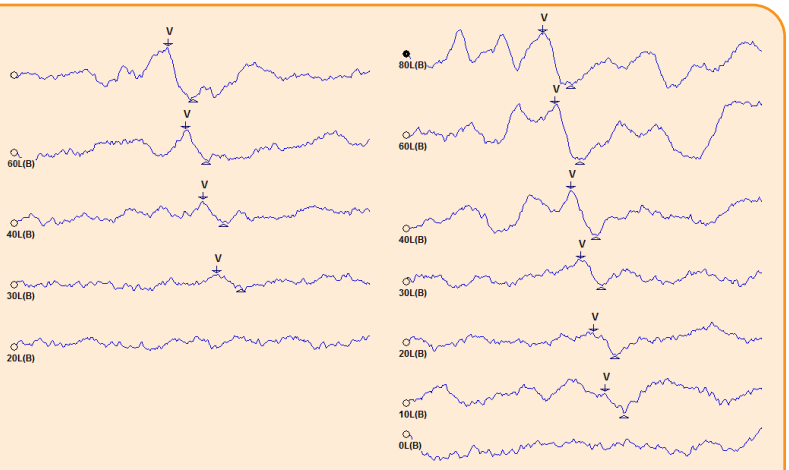
- Objective response measurements provide indicators of recording quality, including SNR, RN, d-prime, Fsp, and Fmp
- Automated averaging stopping rules using residual noise measures allow data to be acquired automatically with consistent quality and noise level criteria

iChirp™ stimuli included

The intelligent Chirp for SmartEP and SmartEP-ASSR is included with all packages.

- Broad and narrow band (500, 1000, 2000, 4000 Hz)
- Improved threshold detection
- Robust amplitude responses
- Optimized wave V identification
- Optional, innovative custom chirp design utility

Beneficial for recording ABR in awake and active patients.



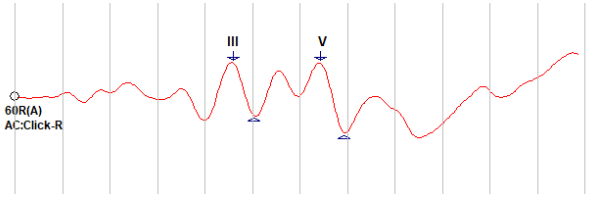
2000 Hz tone burst ABR (left) vs 2000 Hz iChirp ABR (right)

streamlined workflow

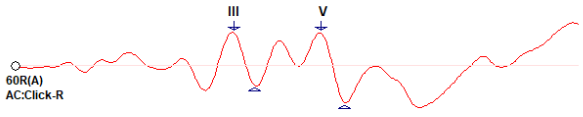
- Easily mark waveforms using over thirty pre-defined peak labels, or create your own custom labels
- Easily adjust peak labels using a mouse or keyboard shortcuts
- Customizable page labels and attributes
- Adjustable display scale
- View latencies and amplitudes of peaks directly on waveforms and in newly embedded recording information panel.
- Automatically arrange recordings by intensity, acquisition order, stimulus frequency, or rate
- Display or hide a subtle vertical grid or horizontal baseline

smart features

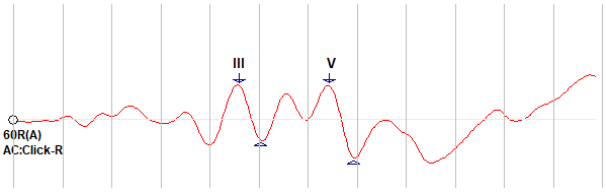
- Reports with multi-page display of EP, OAE, and ASSR data with built-in PDF printing
- Customizable report printouts with options to show/hide parameters and peak label information
- Auto-save reports when exiting the software
- Latency-Intensity graphs showing normative data ranges are automatically generated from marked waveforms
- Split-sweep view to visualize single recording repeatability
- 2D and 3D Spectral Analysis
- Peak extraction utility for advanced data analysis



Recording with grid



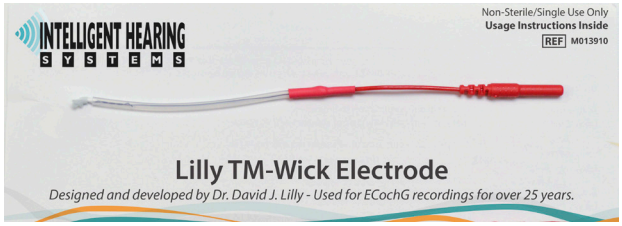
Recording with baseline



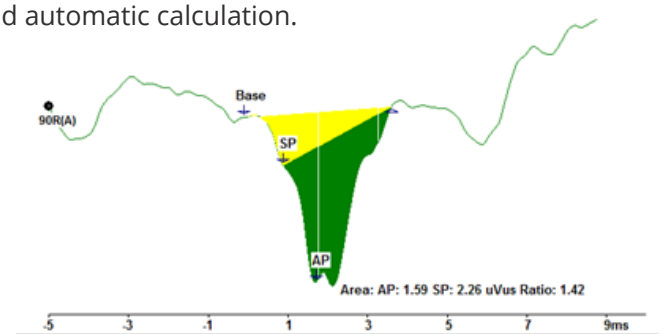
Recording with grid and baseline

optimized for electrocochleography

Our next generation amplifiers combined with the non-invasive IHS Lilly TM-Wick Electrodes produce more robust and repeatable ECochGs.



Improved SP/AP amplitude and area curve ratio analysis and automatic calculation.



SmartVEMP

Innovative solution for cVEMP and oVEMP.

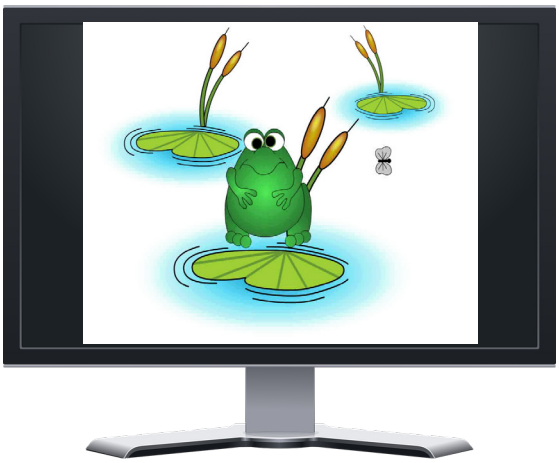
air and bone conduction cVEMP and oVEMP

The SmartVEMP option for SmartEP has regulatory clearance for oVEMP and cVEMP testing on patients of all ages. The most advanced VEMP module available has been enhanced to become the ideal clinical tool for recording oVEMP and cVEMP responses.

integrated EMG monitoring

SmartVEMP includes the ability to monitor EMG activity with the same recording electrodes, therefore there is no need for additional EMG monitoring electrodes.

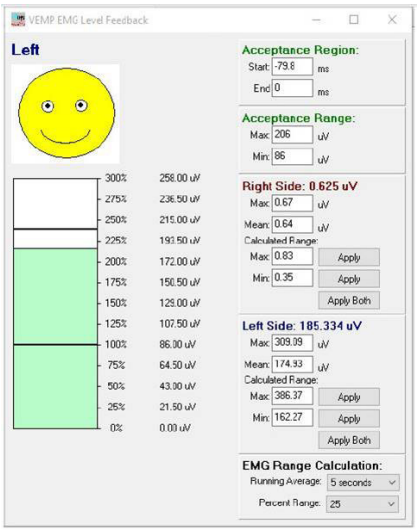
- Choose patient-specific EMG level acceptance amplitudes for each side
- Automatically calculates the EMG acceptance range
- User-defined acceptance and rejection time regions
- Only averages sweeps with adequate EMG activity



improved bio-feedback options

Patient-friendly options for visual bio-feedback:

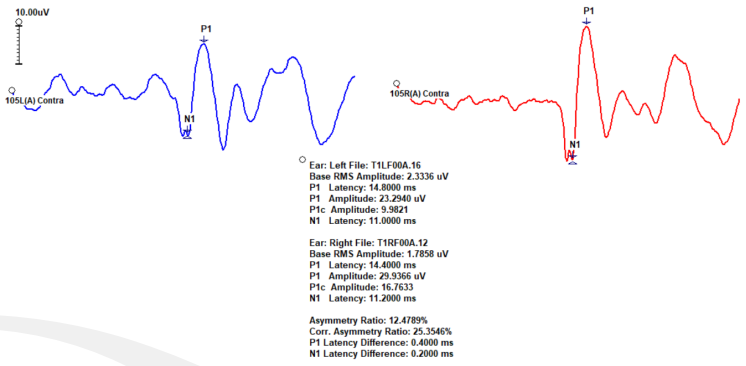
- On-screen EMG level display with happy/sad face
- Animated videos for pediatric testing



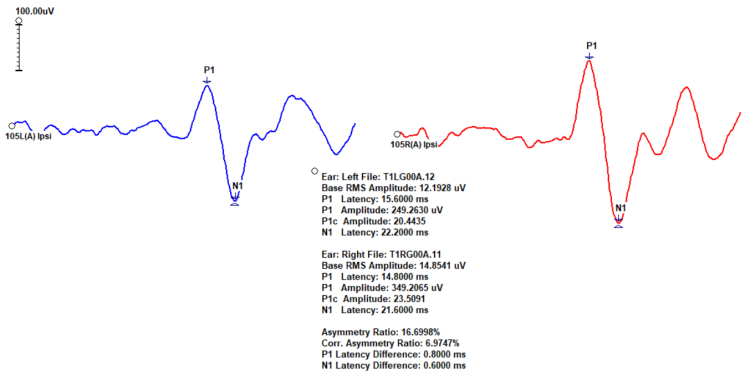
smarter VEMP features

- Quickly load preset cVEMP and oVEMP protocols
- Easy to mark peak labels using mouse or keyboard
- Baseline automatically marked to the user-defined acceptance region
- Integrated baseline EMG response normalization
- Create a grand average using multiple recordings
- Easily compare left and right VEMP responses
- Automatic calculation of corrected amplitude and asymmetry ratios
- Amplitude corrections based on pre-stimulus EMG activity

Sample oVEMP Recordings



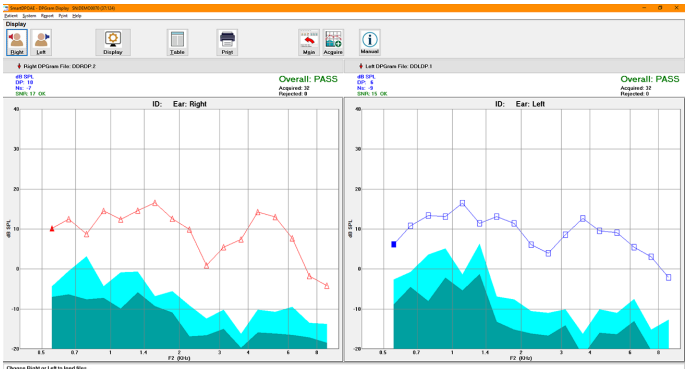
Sample cVEMP Recordings

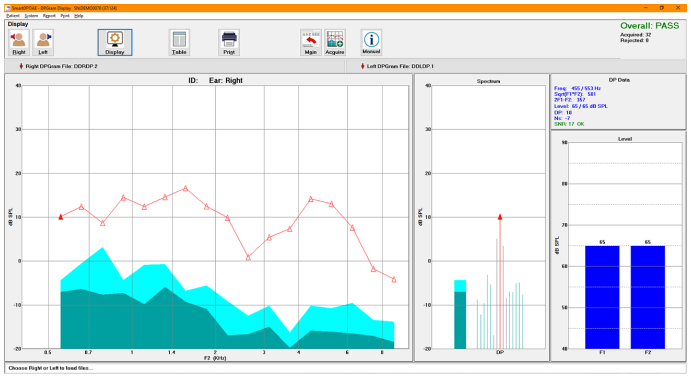


SmartDPOAE

Screening and diagnostic distortion product otoacoustic emissions.

- Fast and easy setup with up to 41 frequencies per ear in a single test
- Automatic probe-fit check and in-ear calibration for increased test accuracy
- Ability to record additional sweeps or retest specific frequencies after acquisition is completed
- Easy-to-interpret colorful DPGrams and detailed information for each frequency tested
- Full color printout of DPGram and recording information table
- View DPGrams from multiple test sessions on the same screen for easy comparison and monitoring
- Clear Pass or Refer indications based on user-selected passing criteria
- User-customizable display of normative ranges on the DPGram facilitates response analysis
- High frequency option for ototoxicity monitoring
- Built-in scripting feature allows you to define sequences of frequencies and intensities for automated data collection
- Optional graphical display of noise standard deviation for improved interpretation

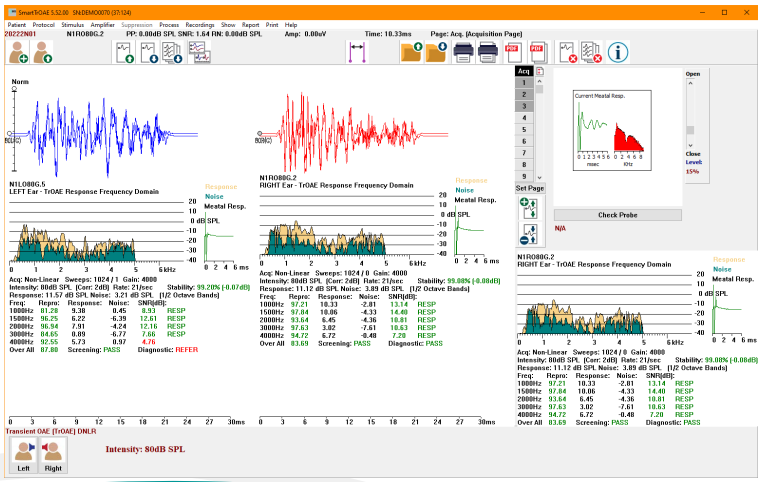




SmartTrOAE

Screening and diagnostic transient evoked and spontaneous otoacoustic emissions.

- Efficient recording of Transient Evoked Otoacoustic Emissions (TEOAE), including Click-Evoked OAE (CEOAE) and Tone-Burst evoked OAE (TBOAE), and Spontaneous OAE (SOAE)
- Automatic probe-fit check with in-ear calibration and stimulus stability measure as a quality indicator
- Pass or Refer indicator based on user-selected passing criteria including reproducibility per band and overall
- Show FFT spectral energy for each band or as aggregate measure of ½ octave bands
- Easily review multiple recordings on the same screen using the integrated analysis panel
- Customizable display showing recordings as time domain recordings, or with spectral plot and data table
- Color indicators to easily display whether the user-selected criteria were met for reproducibility, SNR, stability measures, and Pass/Fail information
- Display of reproducibility of TEOAE on screen and in printed reports
- Displays of the OAE time signal, frequency analysis, the ear canal response, and full range of spectral values (signal and noise)
- Time-Frequency plots can be used to illustrate how the frequency composition of the OAE, Noise, and SNR change over time
- Ability to add two or more recordings to create a grand average
- Ability to export recordings to ASCII files

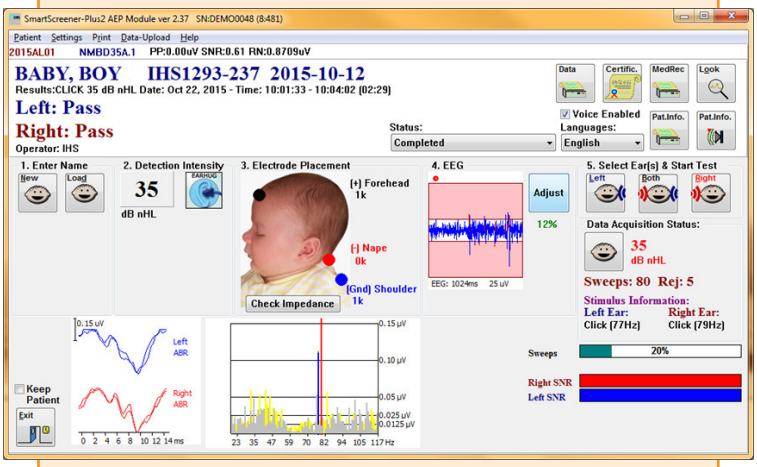


SmartScreener-Plus2

SmartScreener-Plus2 is the most cost-effective, complete, and easy to use infant hearing screener.
It is simple to operate, with step-by-step visual operator instructions.
Friendly voice prompts and alerts guide you through the screening process.

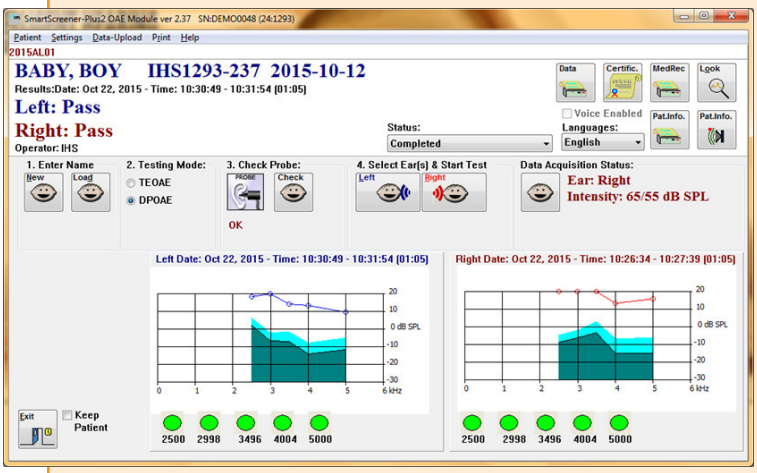
- Your choice of automated ABR, OAE, or both
- Automatic Pass or Refer results
- Fast, accurate, and reliable
- Screening results in as little as two minutes for ABR, and less than a minute for OAE
- Test patients of any age
- Setup different users with varying access levels
- Helpful graphics such as ABR waveform, DPGram, and frequency analysis results
- Integrated Data Back-Up utility allows for a seamless transfer of results to central databases for easy export to Hi*track, OZ-esp, and other databases
- Easily customize and print certificates, parent information letters, and medical records
- Quickly categorize and track pending and completed screenings
- Built-in System Maintenance Utility for easy system checks and automated AEP data analysis
- Documents & Videos Module can be setup as desired using user-supplied materials

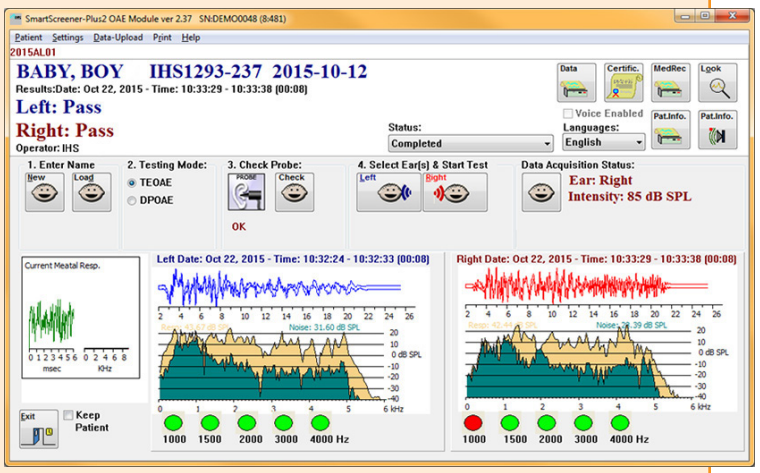
ABR Screening



- Simultaneous testing of both ears
- Fast, mid-line ABR recording electrode setup
- ABR recording electrode placement and impedance values shown on the screen
- Password protected, user-selectable intensity level

DPOAE & TEOAE Screening



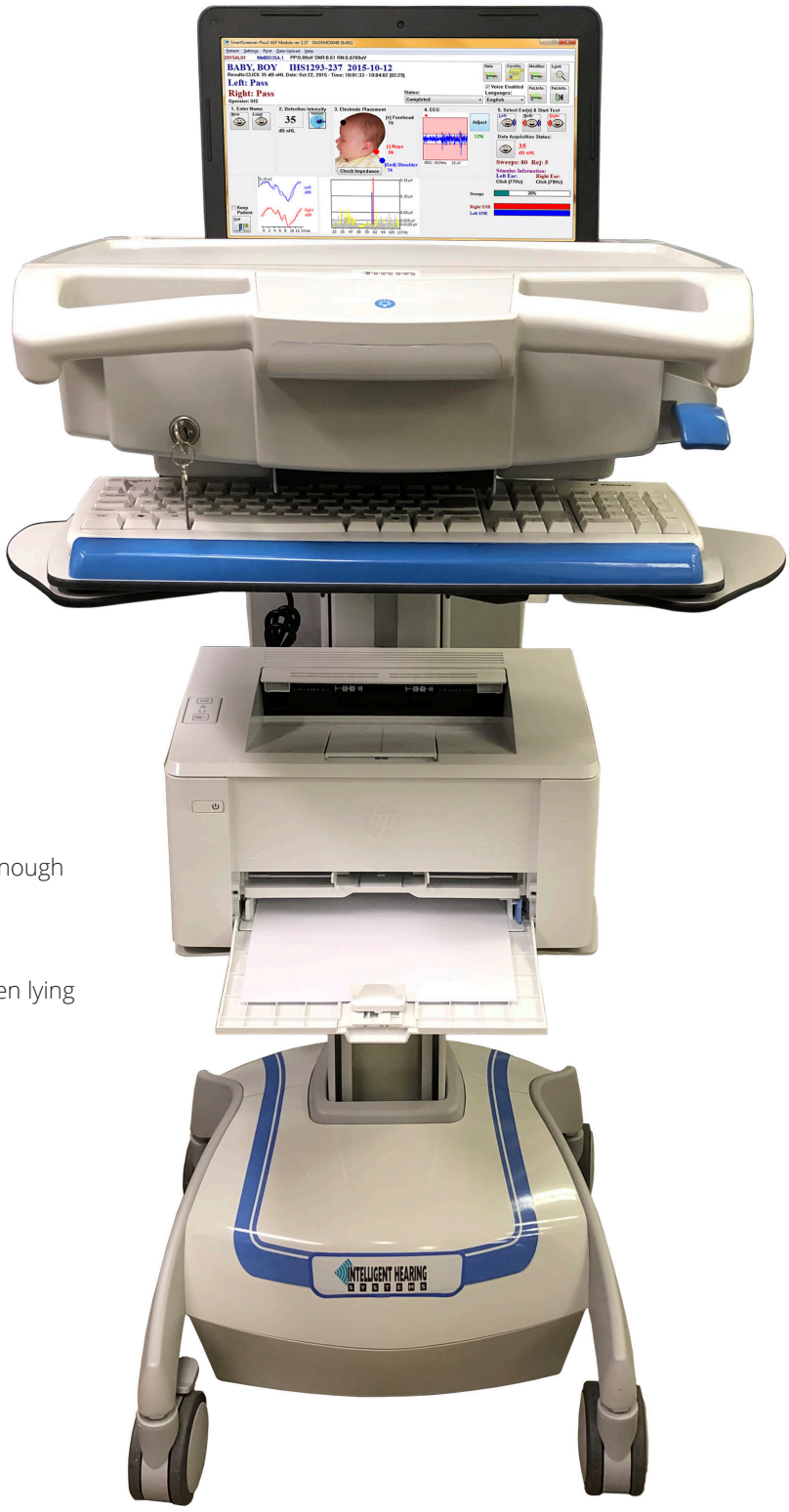


- Automatic probe-fit check to verify proper probe placement
- Ear canal response graph shows quality of probe placement when screening with TEOAE
- DPOAE and TEOAE screenings show passing status for each frequency band
- Password protected, customizable passing criteria and frequency selection

ergonomic ScreenerCart

Ideal for testing at the mother's bedside.

- Convenient height adjustment
- Ample work surface with raised edges and document cover
- Contoured front and rear handles for easy maneuverability
- Built-in bins to store all supplies and documentation
- Easy-to-disinfect keyboard with protective cover
- Integrated keyboard and mouse surface with a keyboard light; work without waking up the baby
- Smooth, non-porous surfaces for easy cleaning, infection control, and durability
- Battery operated: test even when you have no access to an outlet
- Notebook PC & system secured in key-locked compartment
- Coiled power cord for easy cable management
- Convenient wheel locking mechanism
- Built-in isolation transformer



baby-friendly EarHug

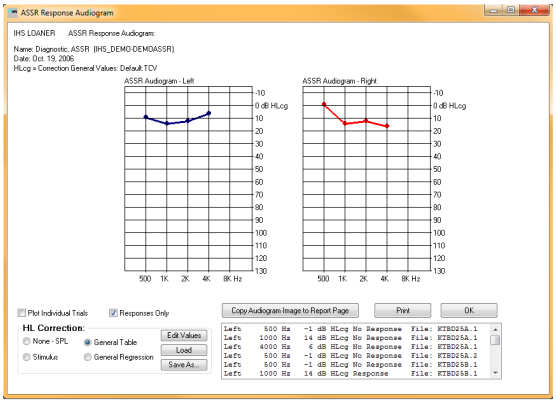
Designed with the baby's comfort in mind.

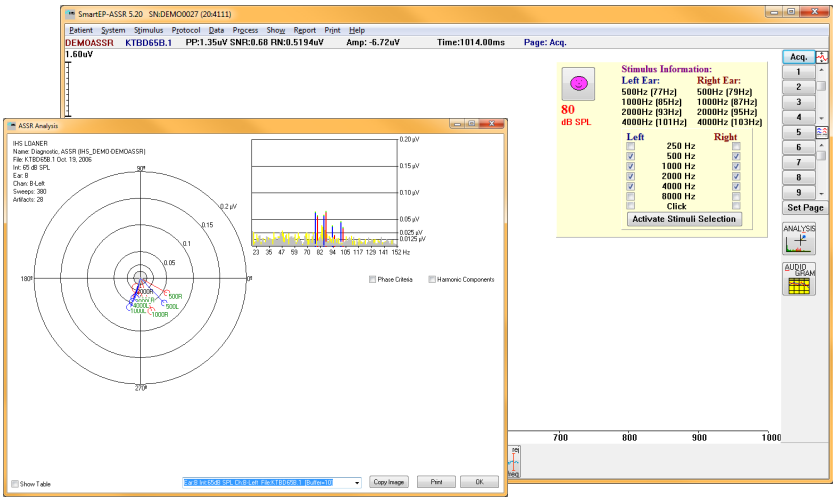
- Cost-effective disposable ear coupler
- Special flexible material adheres to the skin firmly but is gentle enough for comfortable removal
- Large adhesive surface keeps the EarHug from detaching during screening
- Comfortable design allows the baby to easily fall asleep even when lying on the EarHug

SmartEP-ASSR

Full-featured screening and diagnostic Auditory Steady State Response system.

- Provides quick, accurate threshold detection using automated statistical analysis
- Test both ears at the same time, up to four frequencies per ear
- iChirp (broadband & frequency specific) for robust amplitudes and harmonic component analysis for improved threshold detection and reduced test times
- Automated audiogram generation in both SPL and HL
- Ability to save all recording data for ASSR, including the SNR and RN for future analysis
- Cost effective add-on to SmartEP

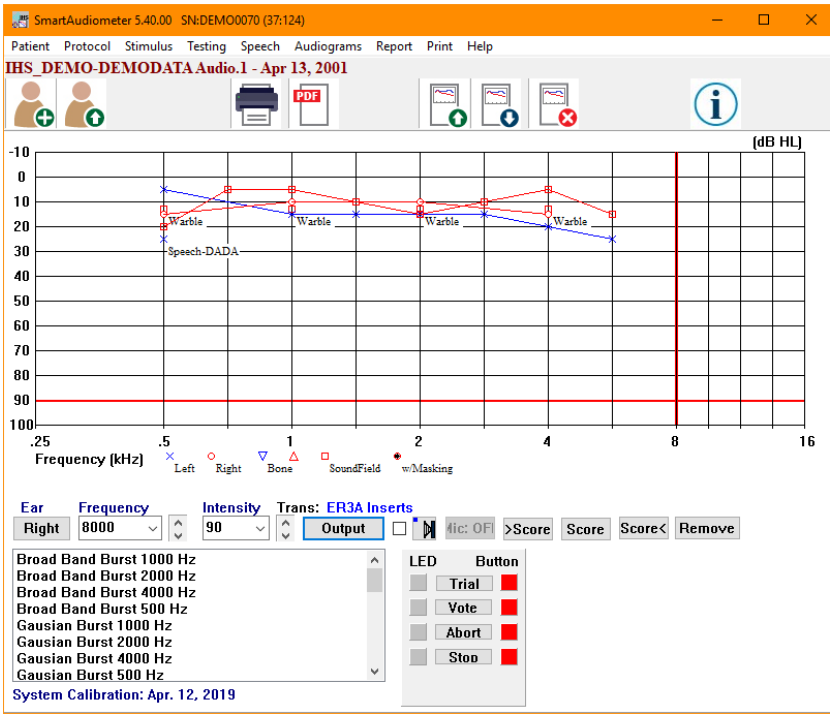




Smart Audiometer

PC-based screening audiometer.

- Automatic generation of pure tones from 250 Hz to 16 kHz (depending on stimulator used)
- Includes a wide array of stimulus files for 500, 1000, 2000, and 4000 Hz: pure tones, warble tone, narrowband burst, small band burst, broadband burst, and Gaussian burst
- Ability to use custom stimuli
- Includes standard clinical '5-up/5-down' routine
- Print detailed reports with sequence information, frequency tables, and threshold information
- Built in audiogram markers for different transducer types
- Optional speech discrimination module



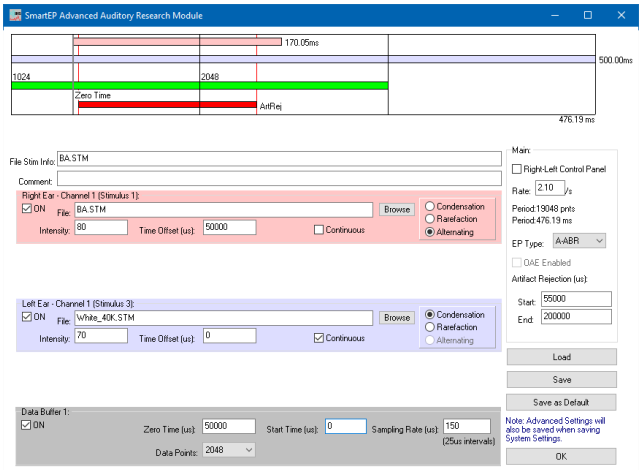
AARM/FFR

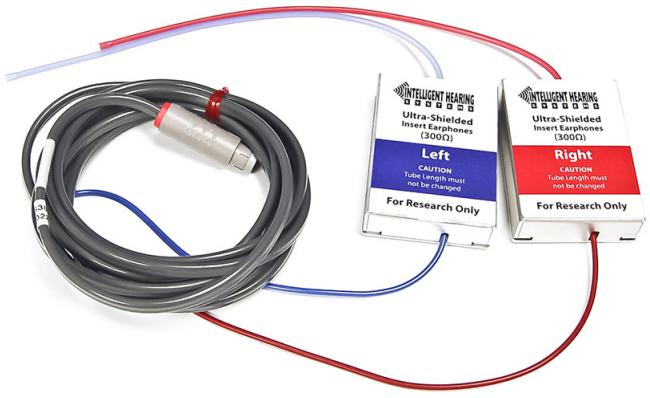
Advanced Auditory Research Module for Frequency Following Response and Acoustic Change Complex*

complete control of stimulus and acquisition timeline

This add-on module for SmartEP allows users to customize every aspect of acquisition and stimulation, using a straight-forward interface; making it an ideal tool for the acquisition of Frequency Following Responses (FFR). It provides the user access to define times of acquisition by specifying delays and offsets for each stimuli selected.

- Present simple or complex stimuli, including tones, iChirps, speech, and noise up to 1s in duration
- Define custom stimuli using the built-in conversion utility
- Set stimuli to be presented at a specific time, or to be output continuously



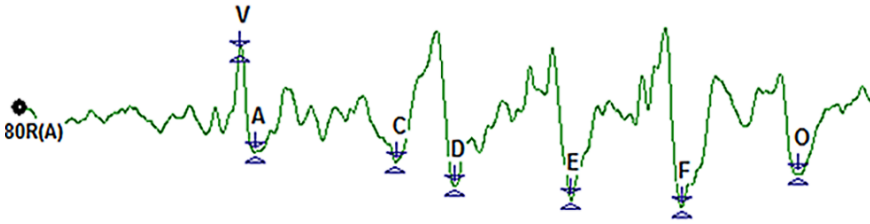


Optional ultra-shielded ER3C insert earphones*

cABR

Complex ABR Research Module*

Acquisition and Analysis of cABR:



- Includes pre-defined settings for complex stimuli, including speech syllables BA, DA, GA, and more
- Users can create customized settings and stimuli
- cABR specific label markers
- Easy comparison of marked recordings
- Includes cABR analysis, spectrogram, and phaseogram tools
- Analysis module includes a cross-correlation function, overlapping stimulus and response, and response power spectrum
- Users can define the response analysis region, high pass, and low pass filters
- Display of filtered and unfiltered spectrogram
- Export data, cross correlation information, or power spectrum of recording for additional external analysis
- Interfaces with MATLAB® modules for further analysis possibilities

*The Advanced Auditory Research Module, cABR Research Module, and Ultra-Shielded Insert Earphones are inteded for research use only; they are not for intended for use in diagnostic procedures.

Audio channel mixing, such as ipsilateral mixing of stimuli or noise, are not available on the Aria.

Research supporting cABR technology was developed by Dr. Nina Kraus and colleagues as Northwestern University.

Visit the Auditory Neuroscience Lab website (www.brainvolts.northwestern.edu), directed by Dr. Nina Kraus, for information about the research supporting the cABR technology and about upcoming scientific talks by Dr. Kraus.

Aria Technical Specifications

GENERAL SPECIFICATIONS

Evoked Potentials: ECochG, ABR, MLR, LLR/ CAEP, SN10, Chained Stimuli ABR, P300, MMN, cVEMP, oVEMP, ASSR, FFR, cABR

Otoacoustic Emissions: DPOAE, TEOAE (CEOAE & TBOAE), SOAE, TEOAE Suppression, HF DPOAE

Audiometry: Audiometer, VRA, VRISD

EP AMPLIFIER

Channels: Single channel with automatic polarity switching

Designation options: Right-Left, Midline

Gain: 5,000 - 100,000 (adjustable)

High Pass Filter:
1 - 100 Hz, (adjustable),
-6 dB/Oct

Low Pass Filter:
30 - 3,000 Hz (adjustable),
-6 dB/Oct

Digital Filters:
Finite Impulse Response (FIR/ Smoothing), Band Pass, Notch

A/D Converter: 16-bit

Sampling rate:
200 to 40,000 Hz (adjustable)

Recording Window:
-2.5 s to 2.5 s (max)
User definable in AARM up to 10s

Data points:
1024 per waveform
Up to 4096 in AARM

Artifact Rejection Level:
Adjustable: 0-100%, and any region within the analysis time window

Line Frequency Notch Filter:
50 or 60 Hz (-12 dB/Oct)

Common Mode Rejection:
≥ 103 dB @ 500 Hz
≥ 105 dB @ 60/50 Hz, notch filter off

Noise Level: ≤ 0.27 uV RMS

Input Impedance: > 10 MOhms

Electrode Impedance:
Measuring frequency: 1,000 Hz
Measuring range: 1 - 25 kOhms

OAE AMPLIFIER

Sampling Rate: 40 kHz

A/D Converter: 16-bit

Frequency Accuracy:
0.01% from selected

EP STIMULUS

Stimulus:
Clicks, Tones, Broadband iChirp and Narrowband / Octave Band iChirps, Complex, Speech, and user-defined files

Stimulus duration:
Defined in µsec or cycles
Click: 100 µs default (adjustable)
Tones and user files:
up to 500 ms (adjustable)
up to 1 second using AARM

Stimulus Envelopes:
Rectangular, Blackman, Exact Blackman, Cosine, Cosine Squared (Hanning), Cosine Cubed, Extended Cosine (Rise/fall time), Triangular (Bartlett), Trapezoidal (Rise/fall time), Gaussian

Stimulus presentation:
Continuously or only while acquiring

Stimulus polarity:
Rarefaction, Condensation, or Alternating

Stimulus Rate:
0.1 - 200 per second,
(dependent on stimulus duration)

Stimulus Output:
Up to 132 dB SPL
(transducer dependent)
Attenuation Range: 150 dB
Level Accuracy: +/- 1dB
D/A: 16-bit

Frequency:
Range: up to 16 kHz
(transducer dependent)
Frequency Accuracy: +/- 1 percent

Masking:
Level: up to 125 dB SPL
Frequency Response: Flat to 20kHz
(transducer limits determine roll off)
Types: Specific or relative to stimulus level. Contralateral White Noise. SAL

TRANSDUCERS

ER-3C Insert Earphones:
Intensity: up to 132 dB SPL
Frequency Range: 125 - 10,000 Hz
Total Harmonic Distortion: <1% @1kHz

DD45 Headphones:
Intensity: up to 120 dB SPL
Frequency Range: 125 - 8,000 Hz
Total Harmonic Distortion: <1% @1kHz

DD450 Headphones:
Intensity: up to 120 dB SPL
Frequency Range: 125 - 16,000 Hz
Total Harmonic Distortion: <1% @1kHz

B81 Bone Conductor:
Intensity: up to 82 dB HL (109 dB SPL)
Frequency Range: 250 - 8,000 Hz
Total Harmonic Distortion: <1% @1kHz

OAE Probe:
Intensity: up to 100 dB SPL
Frequency Range: 125 - 16,000 Hz

ASSR

Gain: 100,000

High Pass Filter: 30 Hz

Low Pass Filter: 300 Hz

Stimulus:
Clicks, Tones, Broadband iChirp and Octave Band iChirps, and user-defined files
Simultaneous testing of both ears
Test up to four frequencies per ear

Frequencies: 250, 500, 1000, 2000, 4000, and 8000 Hz

VEMP

Type: AC & BC cVEMP & oVEMP

Integrated Patient Feedback: Video

P300

Stimulus Presentation Options
2-4 stimuli random
50/50 sequential or random
Reject or accept common after odd
Optional stimulus jitter by percentage

DPOAE

Modes: DP OAE, DP I/O Function

Stimulus: 2 Pure Tones, user defined start, end and F2/F1 ratio
375 - 12,000 Hz, Standard
375 - 16,000 Hz, High Frequency

Levels: 65/55 SPL
(user defined L1, L2, 0-80 dB SPL)

Response Points per Octave:
1-10 (user defined),
up to 41 frequencies per DPGram

Frequency Analysis (FFT) points:
4096

FFT Frequency Resolution:
9.8 Hz Standard,
15.6 Hz High Frequency

Acquisition Time: 102.24 ms

TEOAE

Stimulus:
Click, 75 µs default (adjustable), tones or user files

Modes:
Click Evoked, Tone Burst, Spontaneous

Stimulus Frequency Range:
250 to 6,000 Hz

Presentation:
Linear or non-linear train

Level: 0 - 95 dB SPL (adjustable)

Stimulus Rate: 1-50/s (adjustable)

Response analysis frequencies:
300 - 6,000 Hz

Frequency Analysis (FFT): 1024 points

FFT Frequency Resolution: 39.1 Hz

Acquisition Time: 25.56 ms

Suppression

COMPUTER REQUIREMENTS

Operating System:
Windows 10 or Windows 11

Hardware Required:
Minimum 8 GB RAM
Minimum 5 GB hard drive space
Mouse or other pointing device
1 USB Port with 1.5A, (USB 3.2 Gen-2, Power Delivery, or Battery Charging)

Display:
900 pixels minimum vertical resolution,
Full HD (1920 x 1080) recommended

Power Supply:
Grounded, 3-prong power supply,
Compliant with IEC 60950

External Storage:
Removable media, network drive, or secure internet storage site for data backup (recommended)

Printer:
Software includes PDF printing capabilities, hardcopy printer optional

ENVIRONMENT

Degree of Mobility:
Portable Equipment

Location:
Indoor use

Temperature:
Operating: 15°C - 35°C (59°F - 95°F)
Transport: 0°C - 50°C (32°F - 122F°)
Storage: 0°C - 50°C (32°F - 122°F)

Relative humidity:
Operating and Storage: 15% to 90% (Non-Condensing)

Ambient Pressure:
Operating: 78 kPa -104 kPa
Storage: None Specified

Warm-up Time:
None at room/operating temperature

POWER REQUIREMENTS

USB Powered: +5V DC, 1.5 A, 7.5 W

Fuse Type: Fast Acting
2.5 A, 32 V (IEC 60127-2 compliant)

PHYSICAL CHARACTERISTICS:

Dimensions:
18.5 x 19 x 4 cm (7.3 x 7.5 x 1.57 in)

Weight:
0.45 Kg (1 lbs)

DATA AND SECURITY

Encryption: Advanced Encryption Standard (AES) to encrypt patient demographic information (PHI), using a 256-bit key

Data Export: Ability to export to external patient databases such as Oz-eSP, HiTrack and other hospital systems using HL7 protocols (customization fee may apply)

QUALITY SYSTEM

ISO 13485: Manufactured, designed, developed, and marketed under ISO 13485 certified quality system

STANDARDS COMPLIANCE

Safety and Electromagnetic Compatibility:
IEC 60601-1 Class II, Type BF (Safety)
IEC 60601-1-2 (EMC)
IEC 60601-2-40 (EP)

Electroacoustics - Audiometric Equipment
IEC 60645-6 Type 1
IEC 60645-7 Type 1

Protection from Fluids:
IPX0 – Ordinary equipment

Phone: +1 305 668 6102 • Toll Free: 1 800 447 9783 (USA & Canada)
Fax: +1 305 668 6103 • E-mail: sales@ihsys.com • Web: www.ihsys.com