

## Section II: Schedule of Requirements: - Audiology Equipment for Bhutan

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### PROGRAM OVERVIEW

The Hear, Listen, and Speak Program is a collaboration between the Royal Government of Bhutan, United Nations Technology Bank for Least Developed Countries, Global Foundation For Children With Hearing Loss, and Medtronic Labs.

The goal of this multi-year Program is to help the country of Bhutan establish the continuum of care required to address hearing loss and ear disorders in its children 0-14 years of age. It meets the government's mandate to strengthen child health and education services in the country and to reduce the impact of disability on the Bhutanese people's quality of life.

The Program will build locally-based professional capacity and services in newborn hearing screening, hearing technology, and rehabilitation that are essential for Bhutanese children 0-6 years of age who are deaf or hard of hearing to have a chance to hear and speak. The Program also implements screening and ear and hearing care services for Bhutanese children 7-14 years of age with typical hearing to ensure they have healthy ears ongoing.

It is a national initiative designed to address the complete continuum of care from identification to treatment to rehabilitation. Through delivery of technology, professional training, family education, implementation of services, and community outreach initiatives, we are helping to establish sustainable ear and hearing care for children 0-14 years of age in Bhutan, both now and into the future.

### AUDIOLOGY EQUIPMENT NEEDS

During our assessment of Bhutan's existing hearing care services, it became apparent that there are gaps in essential audiology equipment required to serve pediatric patients. The UN Tech Bank aims to help Bhutan start to address these gaps by procuring **Auditory Evoked Potentials** equipment and a **Hearing Aid Verification System**. The following pages delineate the required specifications for both pieces of equipment in support of this Program.

#### LOT (1): Auditory Evoked Potentials System

*Required Technical Specifications and Timelines for Auditory Evoked Potentials System*

Item to be Supplied	Quantity	Description of Goods	Latest Delivery Date
Auditory-Evoked Potentials (AEP) System	1	Features <ul style="list-style-type: none"> <li>• Wireless technology</li> <li>• Battery packs included</li> <li>• Laptop with software installed</li> <li>• Windows compatible operating system</li> <li>• Portable</li> <li>• Test both ears simultaneously</li> <li>• Bluetooth compatibility</li> <li>• NOAH compatibility</li> </ul>	September 27, 2021

			<ul style="list-style-type: none"> <li>• Noise reduction to reduce/filter electrical artifacts</li> <li>• Starter kit of disposables (electrodes, gel, pediatric size ear tips, etc)</li> <li>• Audiometric headphone with independent calibration</li> <li>• Insert ear phones calibrated on a coupler</li> <li>• Bone conductor</li> <li>• OAE probes for children, newborns (if testing tools include DPOAE, TEOAE)</li> <li>• Waveform storage and recovery feature</li> </ul>	
		Test Modules	<ul style="list-style-type: none"> <li>• Mandatory               <ul style="list-style-type: none"> <li>○ Auditory-Brainstem Response (ABR)</li> <li>○ Auditory Steady State Response (ASSR)</li> </ul> </li> <li>• Optional               <ul style="list-style-type: none"> <li>○ Distortion product otoacoustic emissions (DPOAE)</li> <li>○ Transitory evoked otoacoustic emission (TEOAE)</li> <li>○ Electrocochleography (ECochG)</li> </ul> </li> </ul>	
		Specifications	<ul style="list-style-type: none"> <li>• Stimuli:               <ul style="list-style-type: none"> <li>○ Click: 100 <math>\mu</math>s (200Hz -11kHz)</li> <li>○ Broadband CE-Chirp: at least 200Hz – 11kHz</li> <li>○ Narrow Band CE-Chirp: at least 500 - 4000 kHz</li> <li>○ Tone Burst: at least 250 - 4000 kHz (8000 is best)</li> </ul> </li> <li>• Stimulus Polarity: Condensation, Rarefaction, Alternating</li> <li>• ASSR – up to 4 simultaneous frequencies per ear</li> <li>• Transducer options: Bone, Inserts, Headphone</li> <li>• Bone Conduction: B81 (max output ~75)</li> <li>• Reports: Estimated audiogram, ASSR gram</li> <li>• Power: 100 - 240V, 50/60Hz</li> </ul>	
		Training and Service	<ul style="list-style-type: none"> <li>• At least 1 year warranty</li> <li>• User manual</li> <li>• Training support both initial and ongoing (virtual, in-person, videos)</li> <li>• Personal customer service support</li> <li>• Local distributor support for repairs, service in India, China, Hong Kong, or other countries in proximity to Bhutan</li> </ul>	

Electrode Prep Pads (supplied by equipment manufacturer)	500 (5 boxes of 100)		Electrodes compatible with the Auditory-Evoked Potentials (AEP) System selected as above	
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**LOT (2): Hearing Aid Verification System**
*Required Technical Specifications for Auditory Evoked Potentials System*

Item to be Supplied	Quantity	Description of Goods		Latest Delivery Date
Hearing Aid Verification System	1	Features	<ul style="list-style-type: none"> <li>• Has both Test Box (S-REM) and Real Ear Verification</li> <li>• Binaural Test Box and Real Ear (Tests 2 ears simultaneously)</li> <li>• Binaural Monitor headphones</li> <li>• On-screen virtual keyboard</li> <li>• Print to PDF (EMR compatible)</li> <li>• PC control/display capability</li> <li>• Wireless networking for data transfer</li> <li>• Puttyless coupling in test box</li> <li>• Automated verification</li> <li>• L/R display swap</li> <li>• Binaural Sound Field Assist</li> <li>• Ambient level check for REM</li> <li>• Automated sequenced Speech map testing</li> <li>• Software-assisted probe tube placement</li> <li>• Noah module</li> <li>• Smart calibration/sound field equalization</li> <li>• Off-ear fitting capabilities</li> <li>• Speech map transducers</li> <li>• Ability to store audiograms, RECD measurements &amp; speech mapping curves for review at later date and for comparison at future visits</li> <li>• Counseling tools including modules to educate patients/families on hearing levels, hearing loss, familiar sounds and a way to simulate the hearing loss (by individual ears and binaurally).</li> </ul>	September 27, 2021
		Verification Tools	<ul style="list-style-type: none"> <li>• Calibrated real speech stimuli</li> <li>• Percentile analysis display</li> </ul>	

			<ul style="list-style-type: none"> <li>• DSL5, NAL-NL2, CAMFIT targets</li> <li>• ANSI 2014 test box measurement</li> <li>• Frequency-lowering test stimuli</li> <li>• User-supplied sound files</li> <li>• FM/DM fitting protocol</li> <li>• Multicurve</li> <li>• Wideband Real Ear to Coupler Difference measurement</li> <li>• Speech map comparison tests</li> <li>• SII target ranges built into the equipment</li> <li>• RMS Error from target display and ranges (to assess quality of fit)</li> <li>• Binaural Noise reduction, feedback, occlusion tests</li> <li>• CROS/BiCROS fitting capability</li> <li>• Speech map for telecoil</li> <li>• Binaural Directional test (REM &amp; Test box)</li> <li>• Wideband verification to 12.5 KHz (REM &amp; Test box)</li> <li>• Telephone verification tests for Bluetooth and T-coil enabled hearing aids</li> <li>• MAOF highlighter for frequency lowering</li> <li>• Real Ear to Dial Difference (REDD) measurement</li> <li>• Skull simulator capabilities for verifying bone conduction hearing device fittings</li> </ul>	
		<p>Specifications</p>	<p><b>Real Ear (REM)</b></p> <ul style="list-style-type: none"> <li>• Analyzer frequency range: 200 – 16000Hz</li> <li>• Analyzer filter parameters:             <ul style="list-style-type: none"> <li>○ Tones, warble 1/12 octave</li> <li>○ Speech, noise 1/3 octave</li> </ul> </li> <li>• Analyzer display range: 200 – 12500 Hz</li> <li>• Probe mic noise floor (200 – 12500 Hz): &lt;45 db SPL</li> <li>• Frequency accuracy: 1%</li> <li>• Measurement dynamic range:             <ul style="list-style-type: none"> <li>○ 30 – 135 dB SPL (200 – 2500 Hz)</li> <li>○ 30 – 140 dB SPL (2500 – 12500 Hz)</li> </ul> </li> <li>• Speech-like stimuli:             <ul style="list-style-type: none"> <li>○ Calibrated speech (level and spectrum)</li> <li>○ ISTS, band-limited and s/sh for verifying</li> <li>○ frequency lowering, live speech</li> </ul> </li> <li>• Broadband noise stimuli: tone burst, pseudo-pink noise</li> <li>• Narrowband stimuli: warble sawtooth modulated +/- 3% over 128 ms</li> </ul>	

			<ul style="list-style-type: none"> <li>• User supplied stimuli: WAV file, auto level</li> <li>• Stimulus level range: 40 – 85 dB SPL in 5 dB steps</li> <li>• Measurement accuracy at 1 kHz (CAL position): +/- 1 dB</li> <li>• Measurement accuracy re 1 kHz:                         <ul style="list-style-type: none"> <li>○ 200 – 2000 Hz +/- 1.5 dB SPL</li> <li>○ 2000 – 8000 Hz +/- 2.5 dB SPL</li> <li>○ 8000 – 12500 Hz +/- 4 dB SPL</li> </ul> </li> </ul> <p><b>Test Box (HIT)</b></p> <ul style="list-style-type: none"> <li>• Analyzer frequency range: 200 – 16000Hz</li> <li>• Analyzer filter parameters:                         <ul style="list-style-type: none"> <li>○ Tones, warble 1/12 octave</li> <li>○ Speech, noise 1/3 octave</li> </ul> </li> <li>• Analyzer display range: 200 – 12500 Hz</li> <li>• Probe</li> <li>• Coupler mic noise floor (200 – 12500 Hz): &lt;40 db SPL</li> <li>• Frequency accuracy: 1%</li> <li>• Measurement dynamic range:                         <ul style="list-style-type: none"> <li>○ 30 – 135 dB SPL (200 – 2500 Hz)</li> <li>○ 30 – 140 dB SPL (2500 – 12500 Hz)</li> </ul> </li> <li>• Speech-like stimuli:                         <ul style="list-style-type: none"> <li>○ Calibrated speech (level and spectrum)</li> <li>○ ISTS, band-limited and s/sh for verifying</li> <li>○ frequency lowering, live speech</li> </ul> </li> <li>• Broadband noise stimuli: tone burst, pseudo-pink noise</li> <li>• Narrowband stimuli: pure tone</li> <li>• User supplied stimuli: WAV file, auto level</li> <li>• Test stimulus levels: 40 – 90 dB in 5 dB steps</li> <li>• Test stimulus distortion (tone):                         <ul style="list-style-type: none"> <li>○ &lt;2% at 90 db SPL</li> <li>○ &lt;0.5% at 70 db SPL</li> </ul> </li> <li>• Measurement accuracy at 1 kHz (CAL position): +/- 1 dB</li> <li>• Measurement accuracy re 1 kHz:                         <ul style="list-style-type: none"> <li>○ 200 – 2000 Hz +/- 1.5 dB SPL</li> <li>○ 2000 – 8000 Hz +/- 2.5 dB SPL</li> <li>○ 8000 – 12500 Hz +/- 4 dB SPL</li> </ul> </li> <li>• Harmonic distortion measurement: 2nd and 3rd or 2nd plus 3rd</li> <li>• Harmonic distortion range: 200 – 4000 Hz</li> <li>• Harmonic distortion accuracy: +/- 1%</li> <li>• Battery drain range (+/- .01 mA): 0 – 20 mA</li> <li>• Battery drain accuracy: +/- 5%</li> <li>• Telecoil loop accuracy: +/- 3 dB</li> </ul>	
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		Training and Service	<ul style="list-style-type: none"> <li>• Two year warranty</li> <li>• Free software upgrades</li> <li>• User manual</li> <li>• Interactive, context-sensitive help support in equipment</li> <li>• Training support (virtual, video library, or in-person)</li> <li>• Customer service support</li> <li>• Local distributor support in India, China, Hong Kong, or other countries in proximity to Bhutan</li> </ul>	