

# **Case Studies and Critical Thinking**

**Jason Smalley**

The most important bit about testing newborns is that no one test gives you ever answer

Remember a few golden rules and you can start to critically think to put the picture together

- 1) Post term infants with present TE-OAEs, should have an ABR present to normal levels - if they don't, its either a technical fault or ANSD
- 2) Presence of OAEs means the middle ear is clear (you don't need tympanometry). Their absence means nothing
- 3) Children with AC ABR thresholds over 70eHL are not going to have a purely conductive hearing loss in that ear

4) High frequency tympanometry can be miss-leading - always go off the bone conduction

Coming up are a series of anonymised real life cases

We're going to use the principles of today to discuss each one but theres no real right or wrong answers with these, some are straight forward, some are 'once in a blue moon' kind of cases!

# Case 1

Unilateral referral from NHSP - NCR Right

Well baby, now 3 weeks corrected age, no significant history

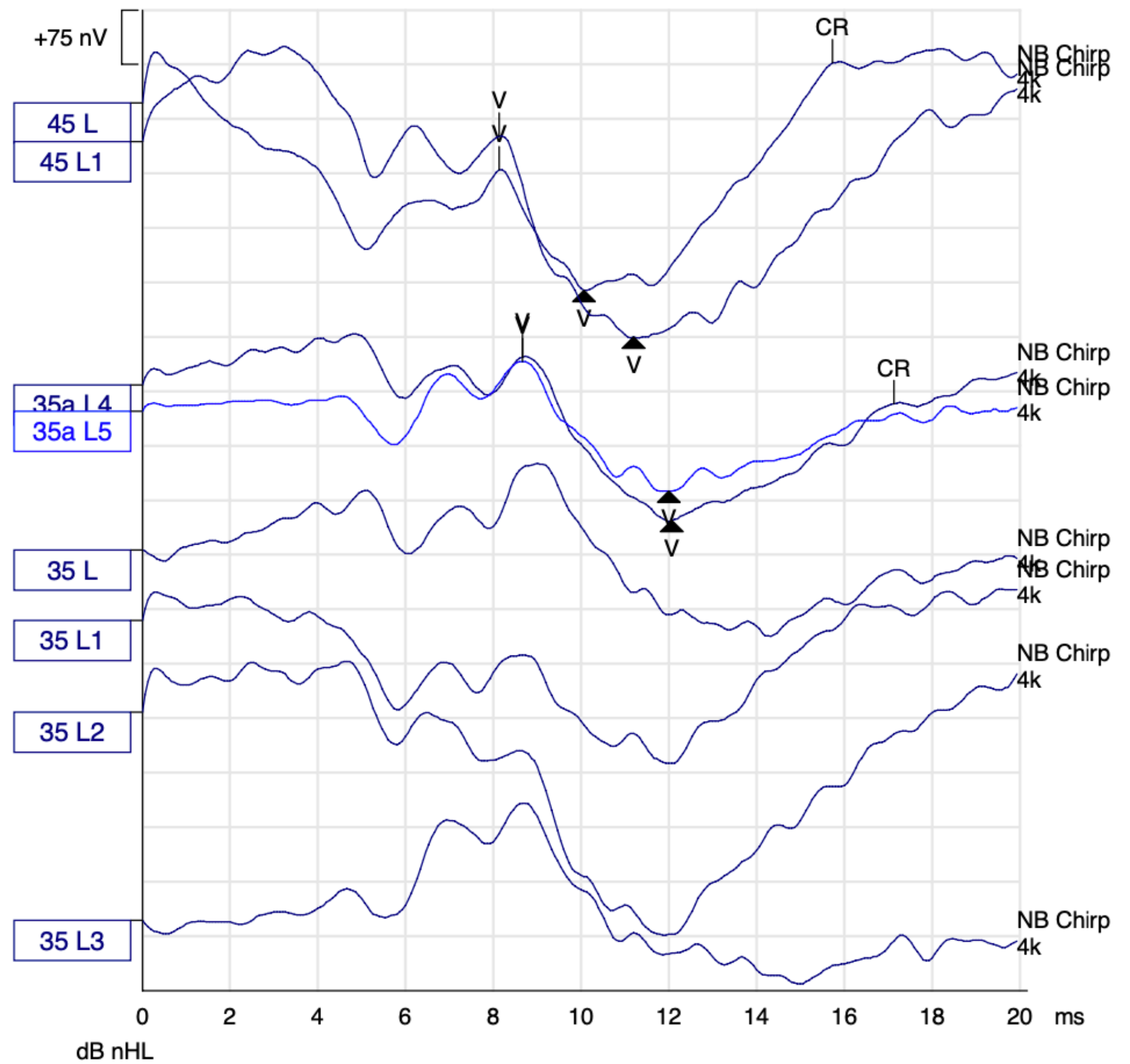
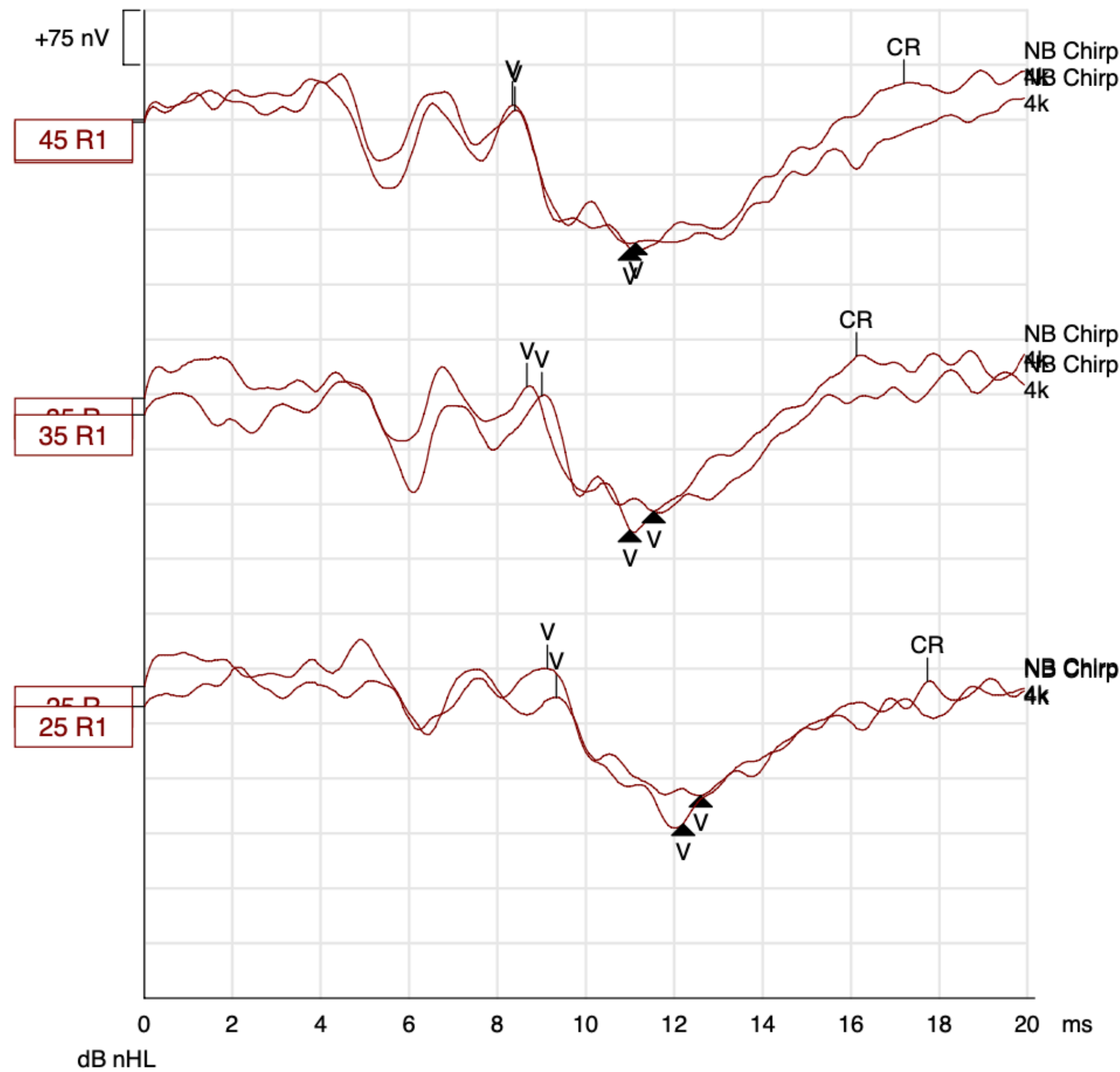
“Arrived asleep but was disturbed by electrode fitting, fell back to sleep but EEG was initially noisy”

What shall we do first?

OAE

Clear Response Right 2.8 and 4kHz

Clear Response Left 2.8 and 4kHz



4kHz air conduction using Headphones - nHL to eHL correction is -5

What next?

## **Case 2**

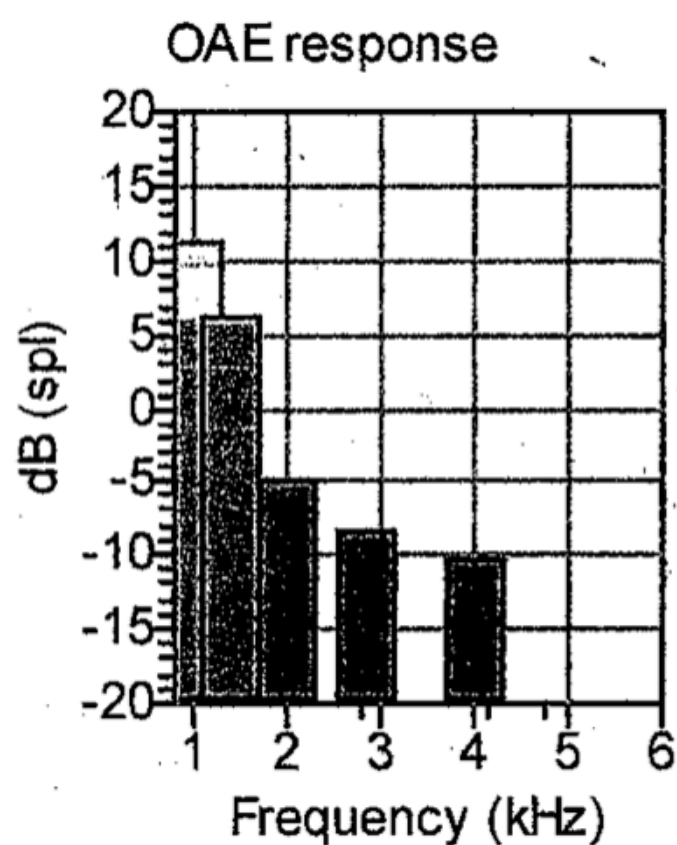
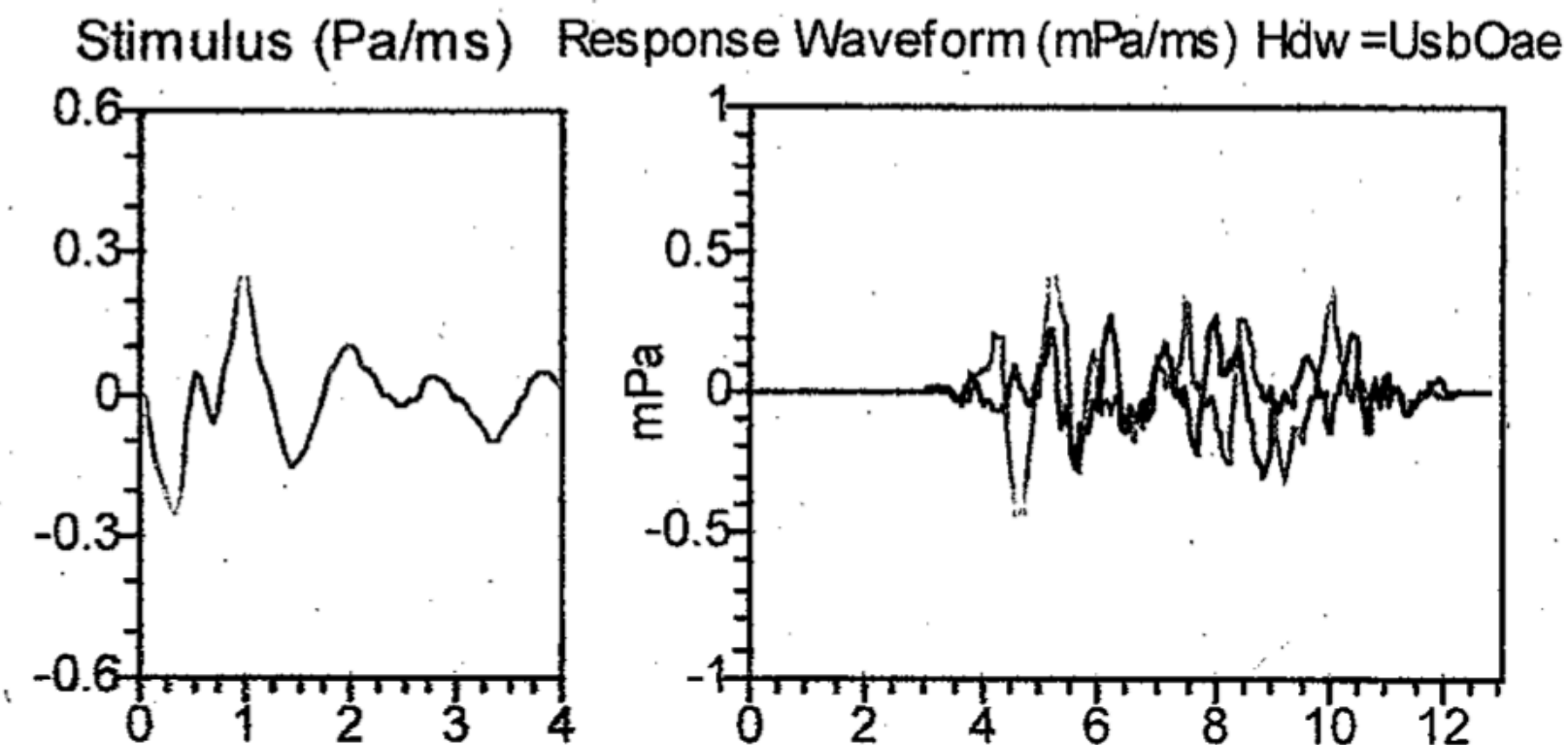
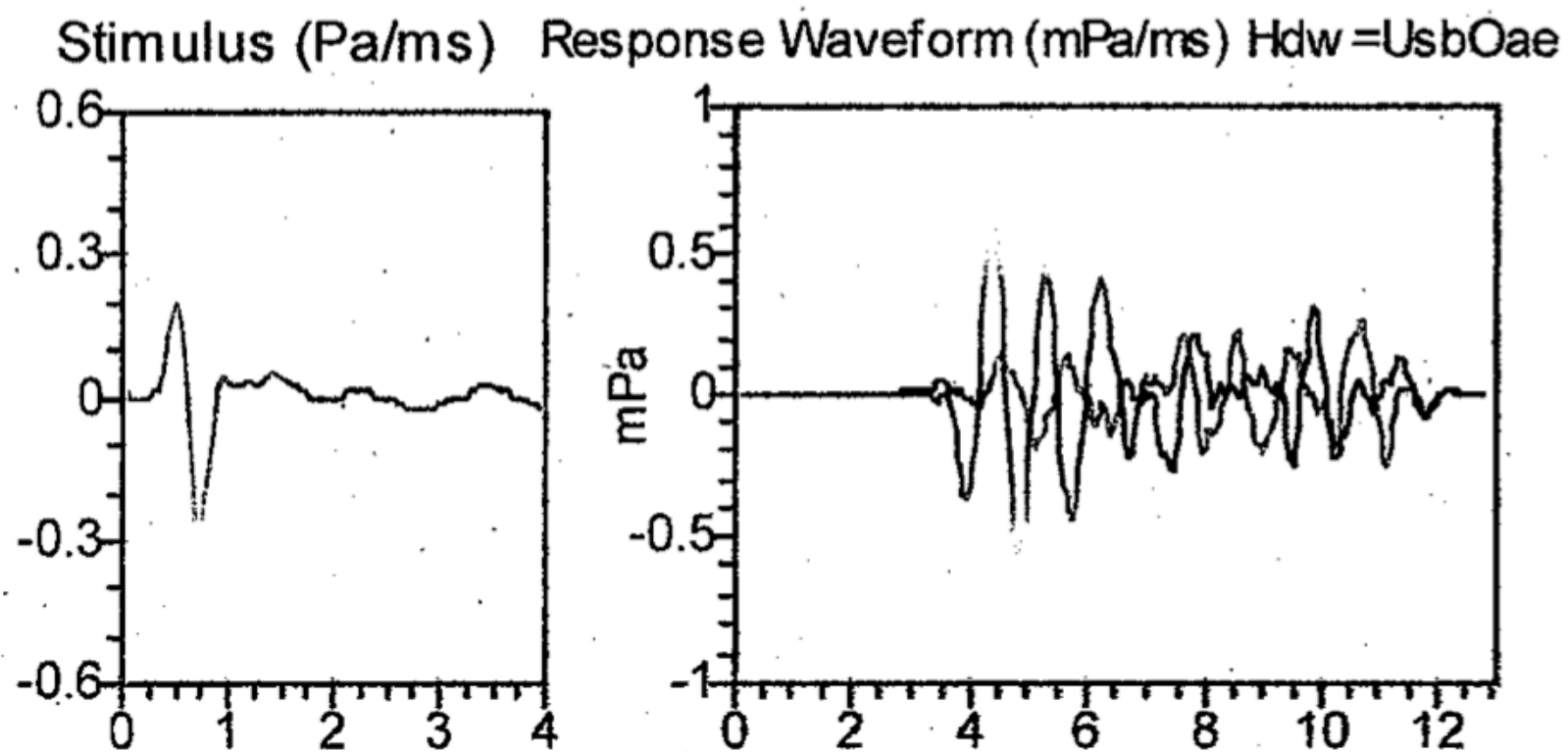
Bilateral referral from NHSP

Well baby, now 2 weeks corrected age, no significant history

**Left ear**

NOTES:

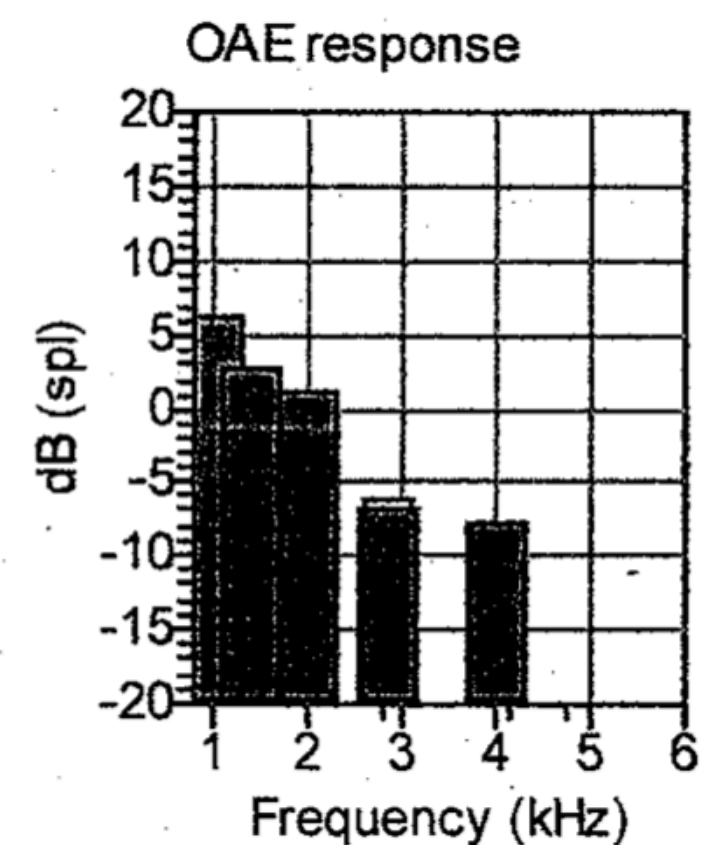
**Right ear**



Half Octave Band Power

Freq	SNR	Sig/Noise
1.0kHz	-10.5dB	0.8/11.3dB
1.4kHz	-4.6dB	1.6/6.3dB
2.0kHz	-7.3dB	-12.2/-4.9dB
2.8kHz	-6.0dB	-14.2/-8.2dB
4.0kHz	-3.3dB	-13.6/-10.3dB

NLo=109 NHi=1207 Stim=81.2dB



Half Octave Band Power

Freq	SNR	Sig/Noise
1.0kHz	-5.6dB	0.5/6.0dB
1.4kHz	-8.1dB	-5.5/2.6dB
2.0kHz	-6.4dB	-5.3/1.1dB
2.8kHz	0.8dB	-6.1/-6.9dB
4.0kHz	-3.3dB	-11.2/-7.9dB

NLo=61 NHi=721 Stim=81.9dB

**Test details**

Test type: TE  
 Ear: Left  
 Tester ID: 2  
 Date/Time of test: 09/03/2022 10:32:25  
 Data file name: DF9W3930.DTA

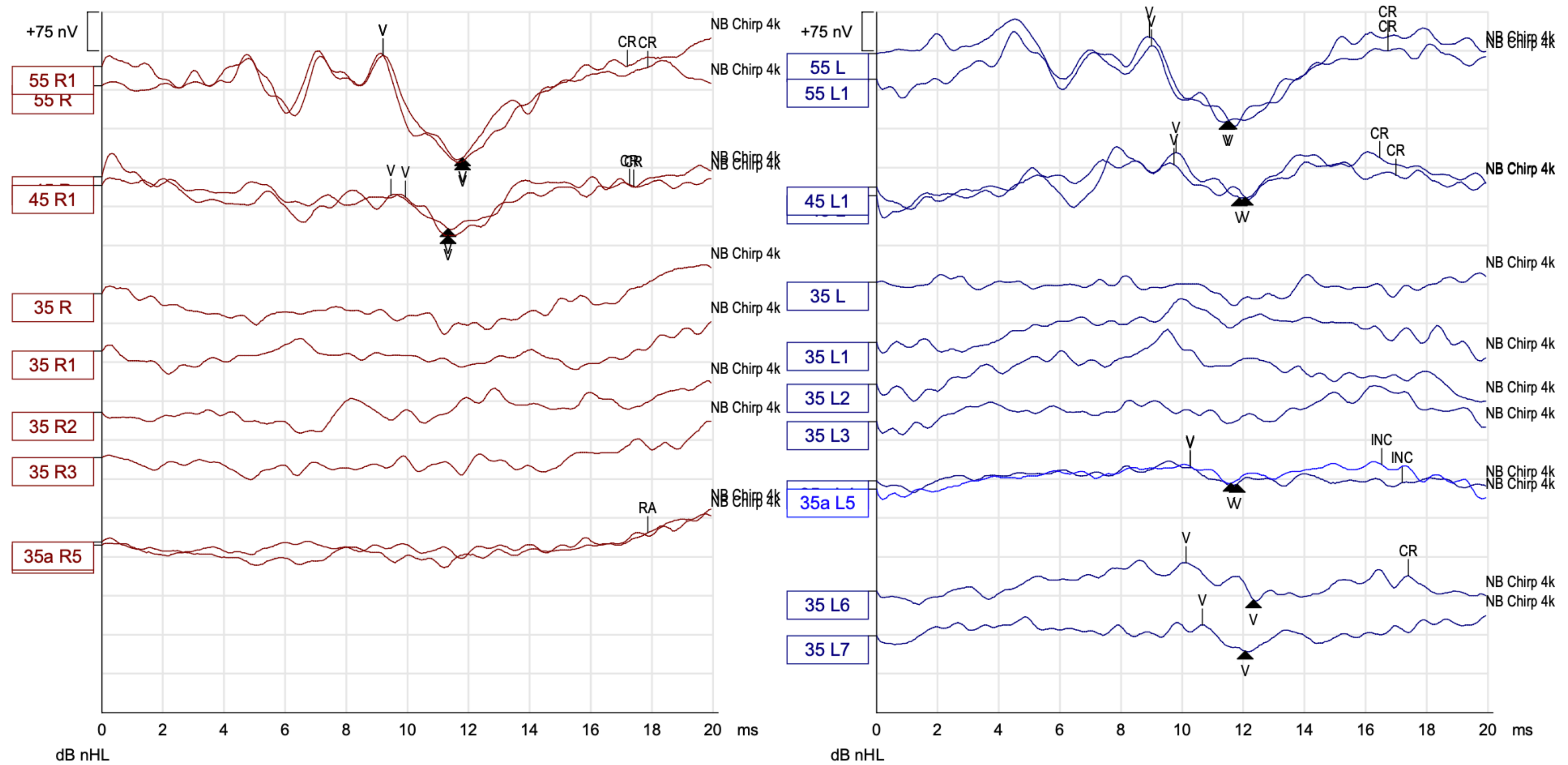
**Result** Too noisy  
**Decision** Retest

**Test details**

Test type: TE  
 Ear: Right  
 Tester ID: 2  
 Date/Time of test: 09/03/2022 10:39:19  
 Data file name: DF9W3931.DTA

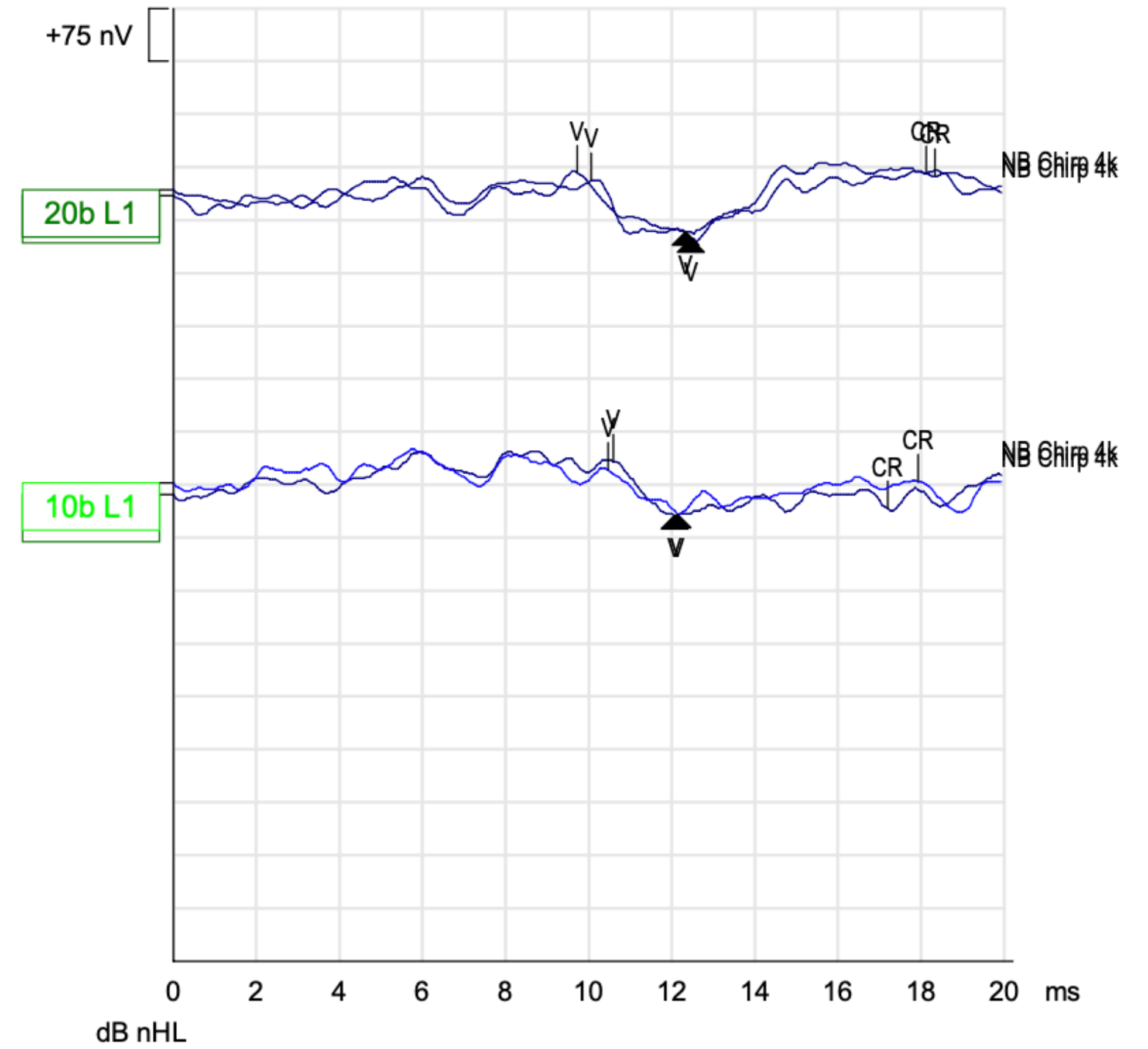
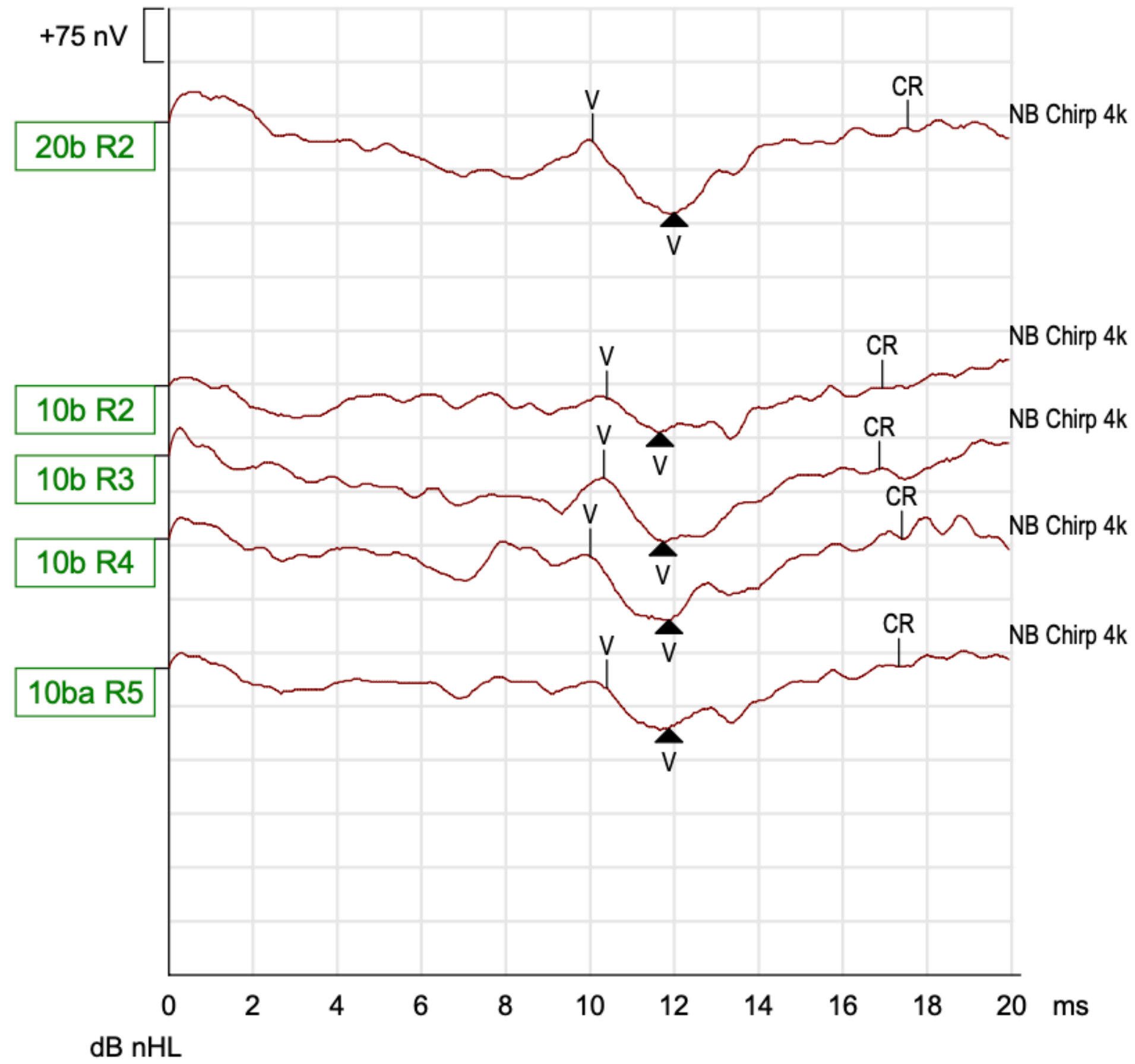
**Result** Too noisy  
**Decision** Retest





4kHz air conduction using Headphones - nHL to eHL correction is -5

What next?



4kHz bone conduction- nHL to eHL correction is +5

What next?

## Case 3

Bilateral referral from NHSP

NICU baby, born 36 weeks GA now 3 weeks corrected age, on NICU as small birth weight

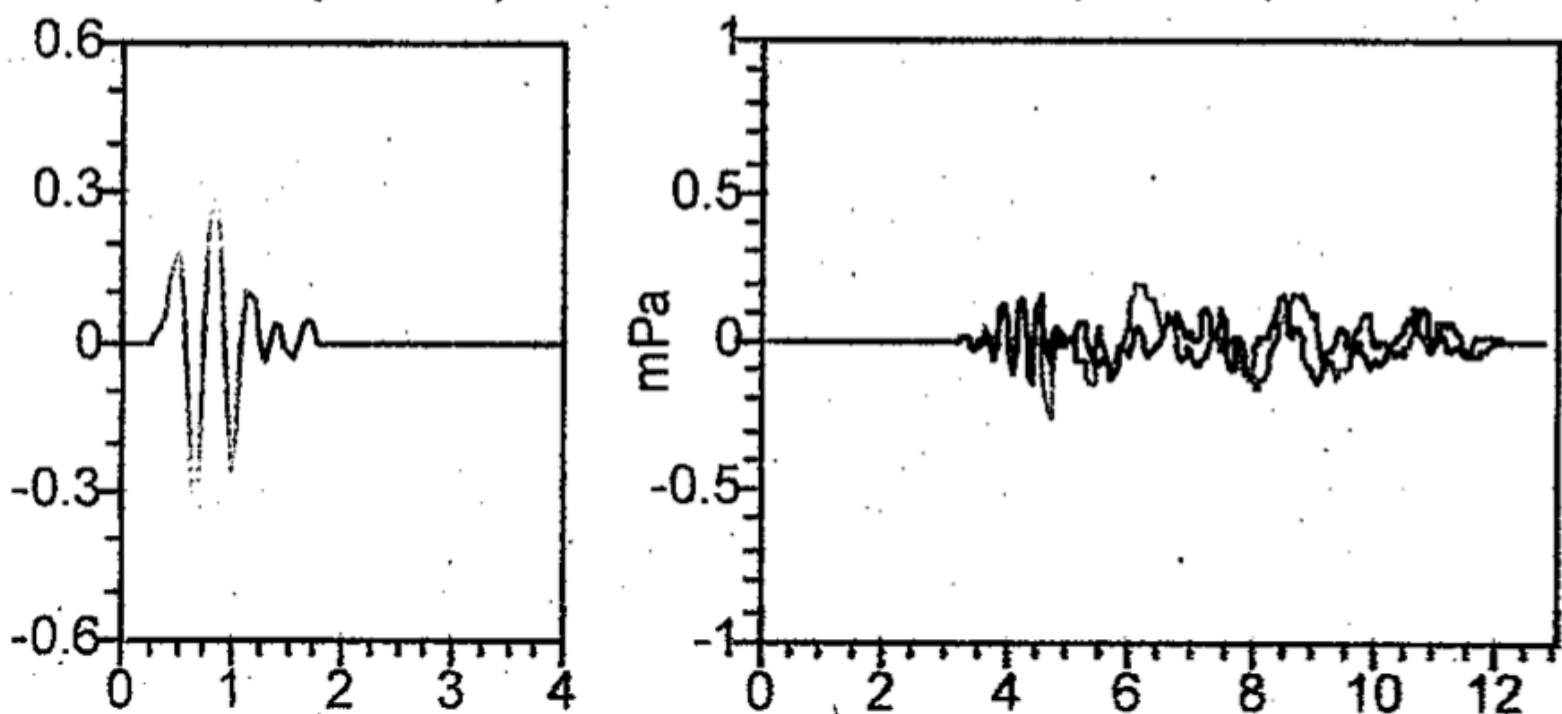
No significant medical history, family is known to Social Services and on a Child in Need plan

**Left ear**

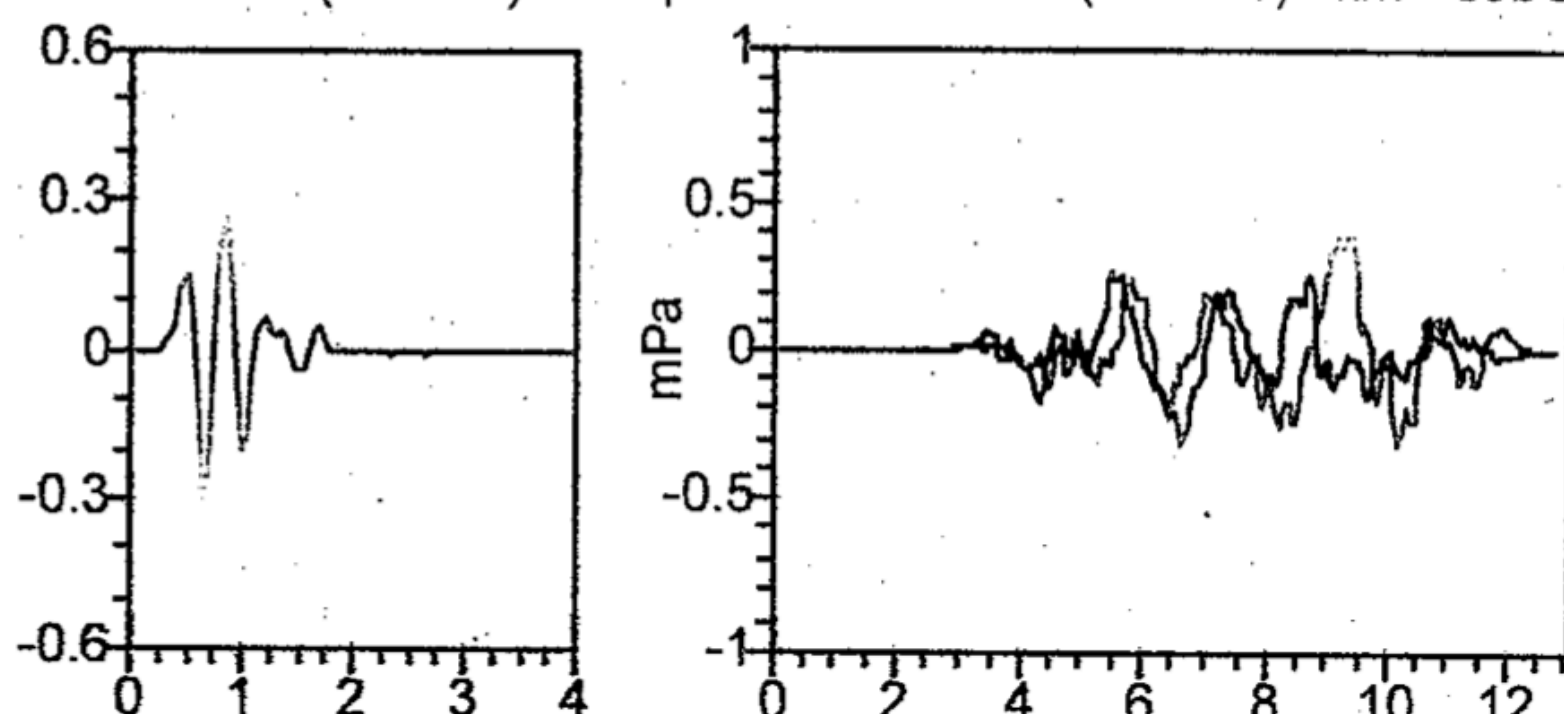
NOTES:

**Right ear**

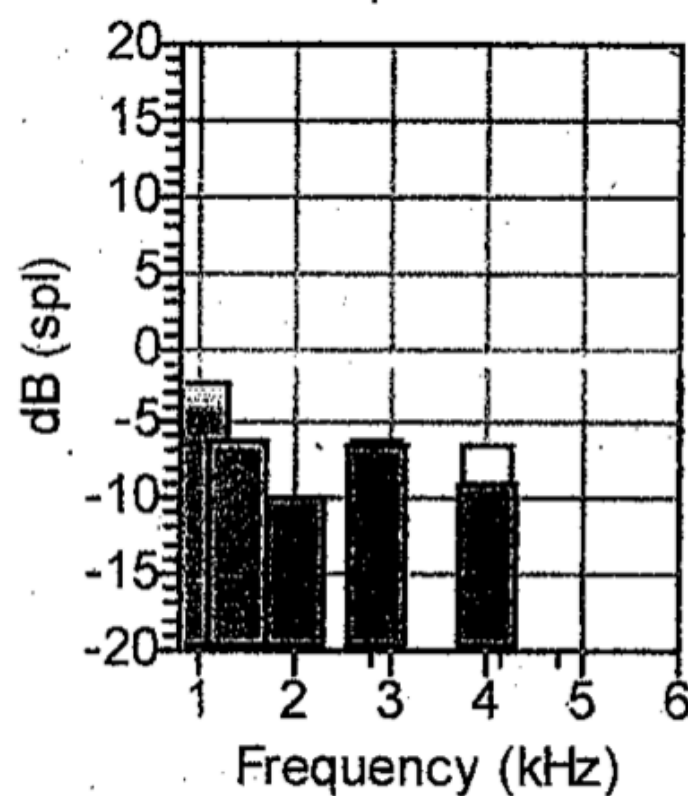
Stimulus (Pa/ms) Response Waveform (mPa/ms) Hdw =UsbOae



Stimulus (Pa/ms) Response Waveform (mPa/ms) Hdw =UsbOae



OAE response

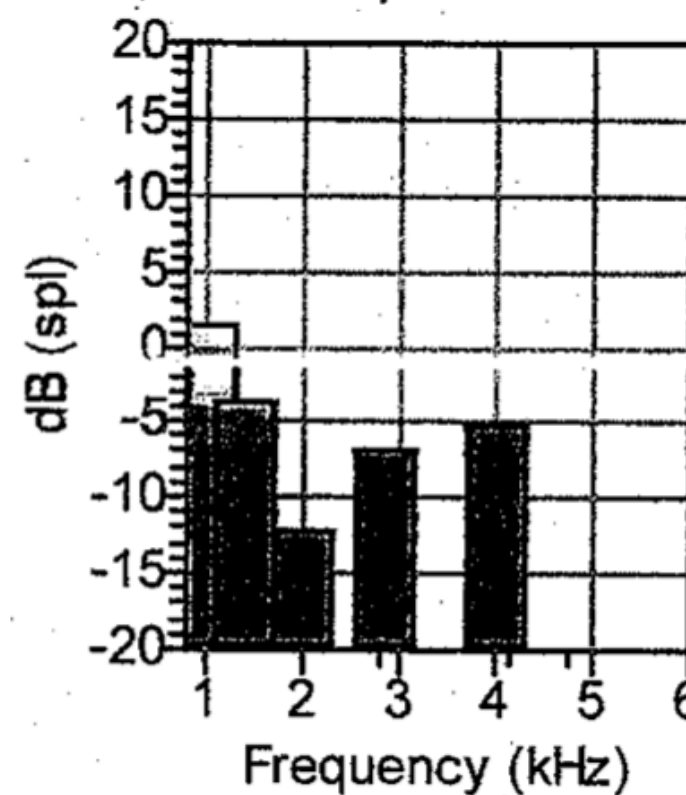


Half Octave Band Power

Freq	SNR	Sig/Noise
1.0kHz	-3.0dB	-5.5/-2.5dB
1.4kHz	-9.0dB	-15.2/-6.2dB
2.0kHz	-4.7dB	-14.5/-9.6dB
2.8kHz	0.3dB	-6.2/-6.5dB
4.0kHz	2.7dB	-6.3/-9.1dB

NLo=260 NHi=379 Stim=84.0dB

OAE response



Half Octave Band Power

Freq	SNR	Sig/Noise
1.0kHz	-8.8dB	-7.4/1.4dB
1.4kHz	-4.8dB	-8.4/-3.5dB
2.0kHz	-1.3dB	-13.3/-12.1dB
2.8kHz	-2.8dB	-9.6/-6.7dB
4.0kHz	-12.1dB	-17.4/-5.3dB

NLo=125 NHi=114 Stim=82.5dB

**Test details**

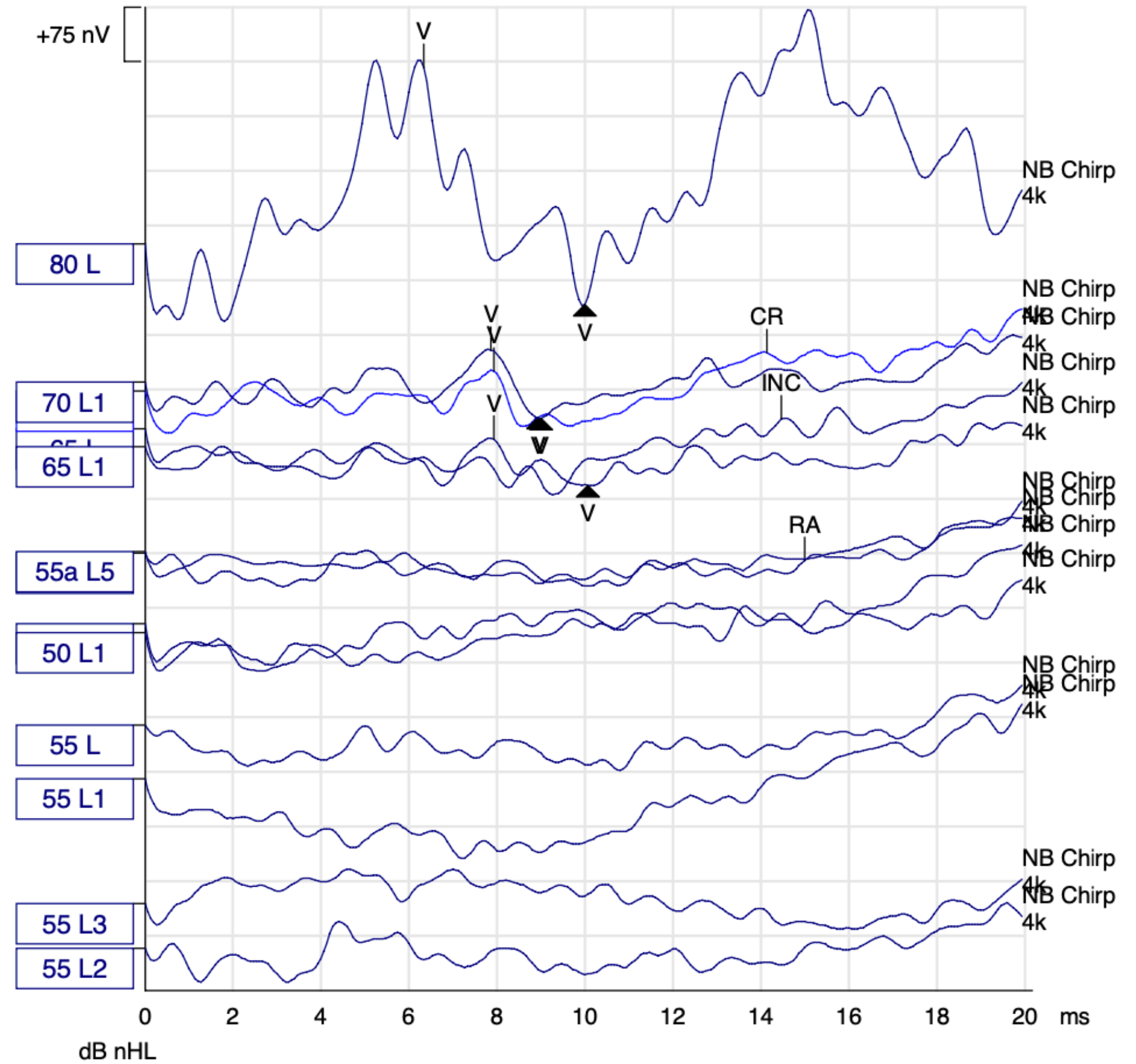
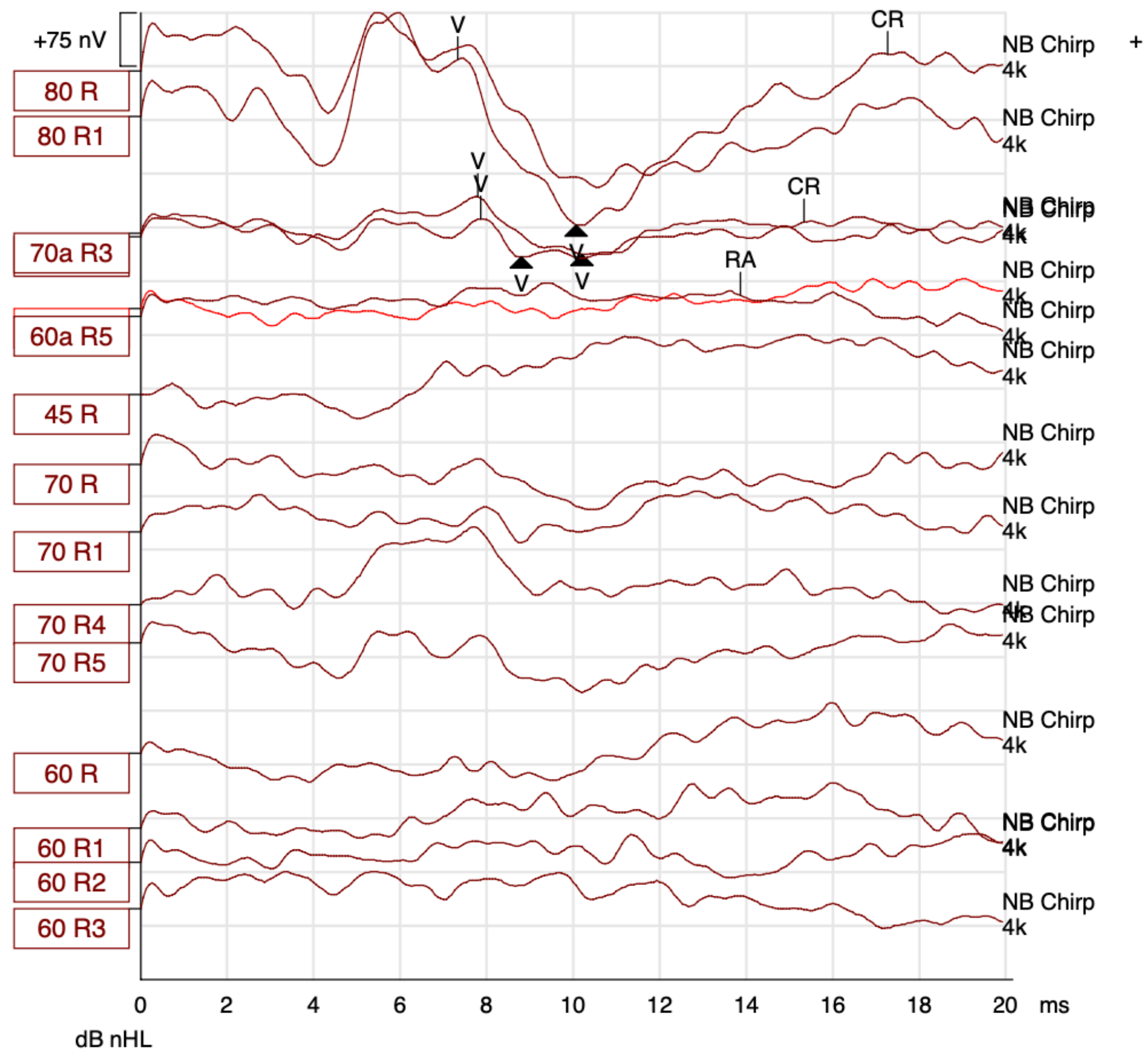
Test type: TE  
 Ear: Left  
 Tester ID: 2  
 Date/Time of test: 08/03/2022 13:33:22  
 Data file name: DF9W3832.DTA

**Result** Re-test required  
**Decision** Retest

**Test details**

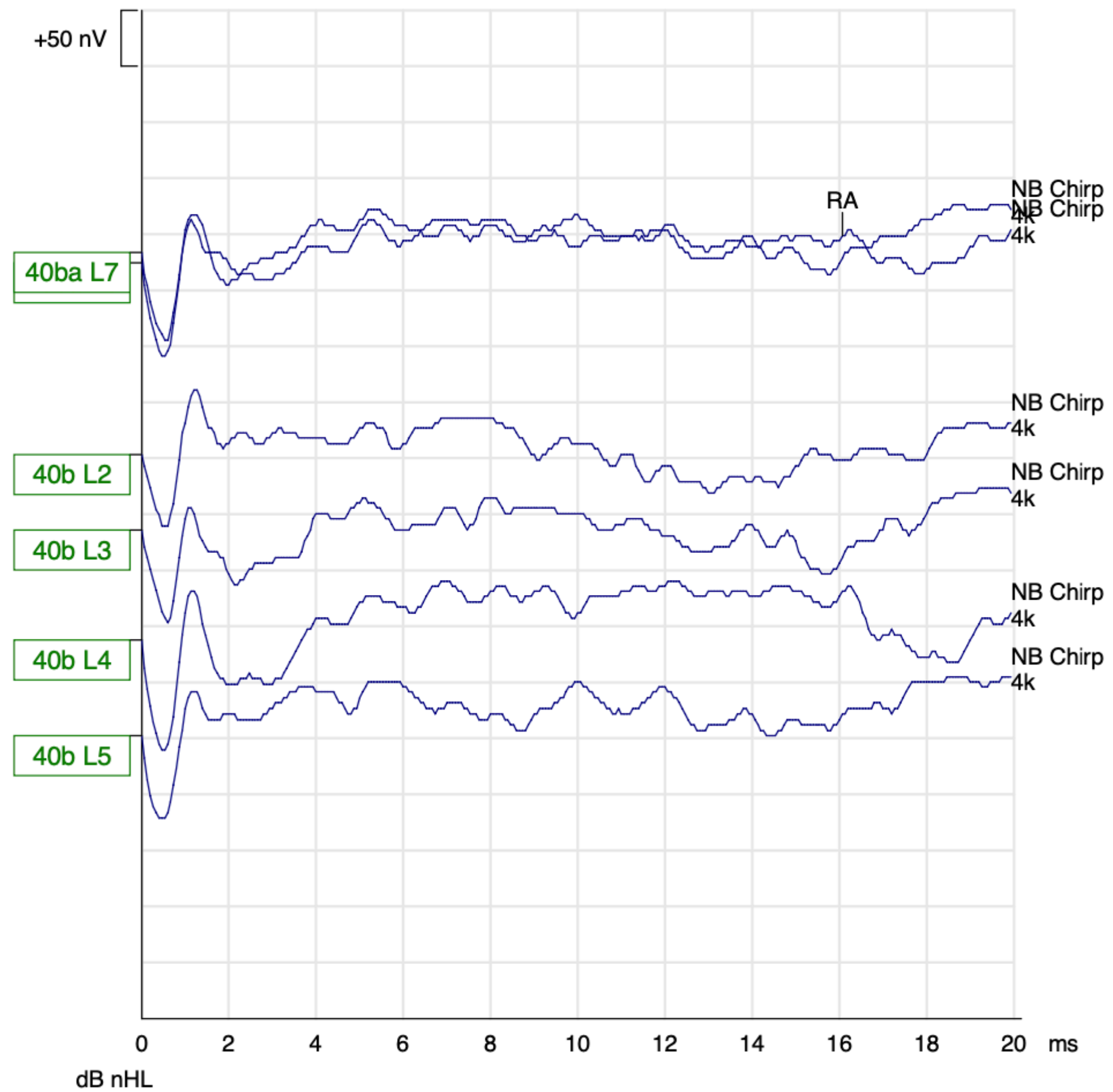
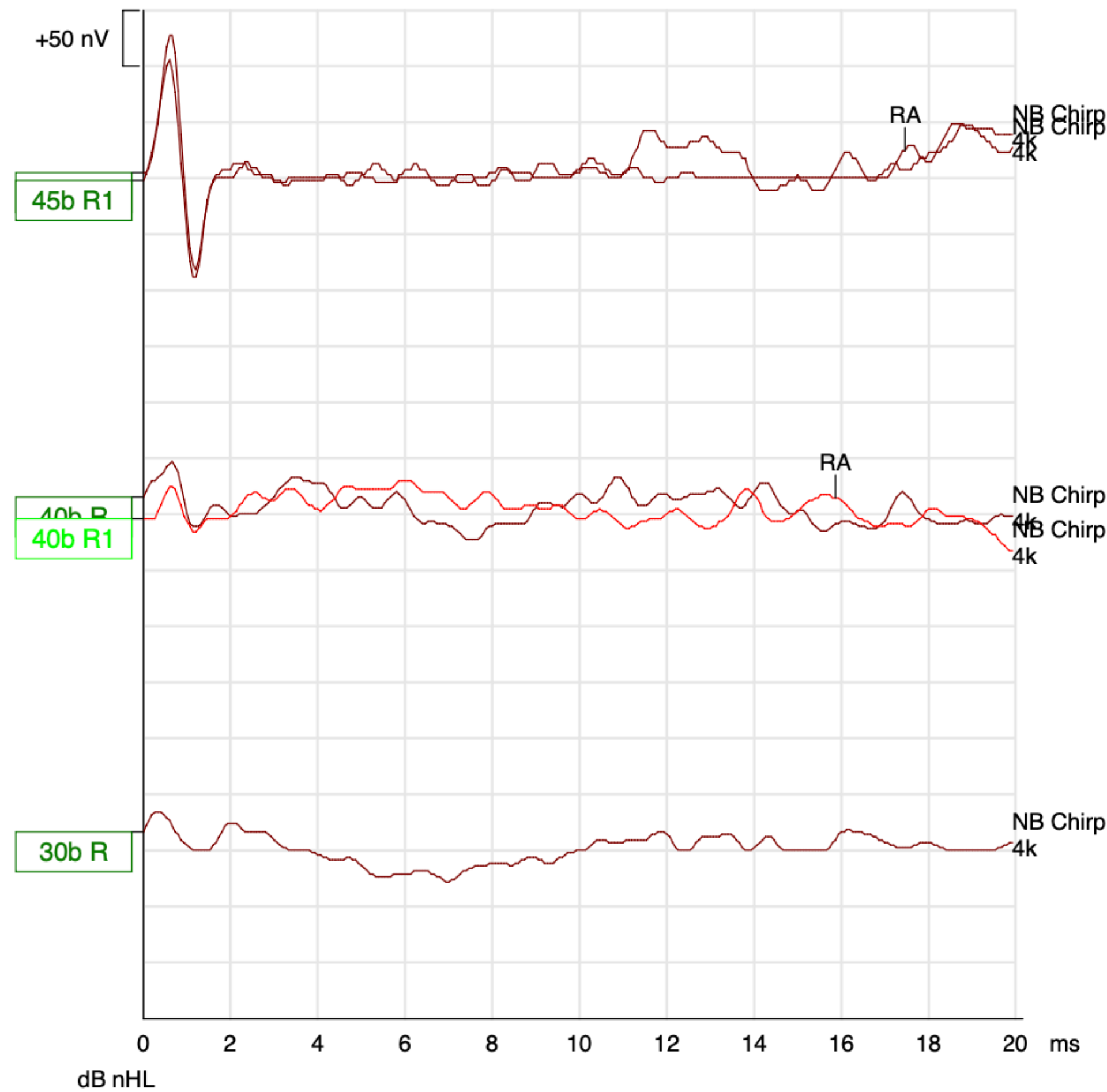
Test type: TE  
 Ear: Right  
 Tester ID: 2  
 Date/Time of test: 08/03/2022 13:35:20  
 Data file name: DF9W3833.DTA

**Result** Re-test required  
**Decision** Retest



4kHz air conduction using Headphones - nHL to eHL correction is -5

What next?



4kHz bone conduction - nHL to eHL correction is +5

Baby wakes up, won't sleep again - what we telling parents? Next steps?

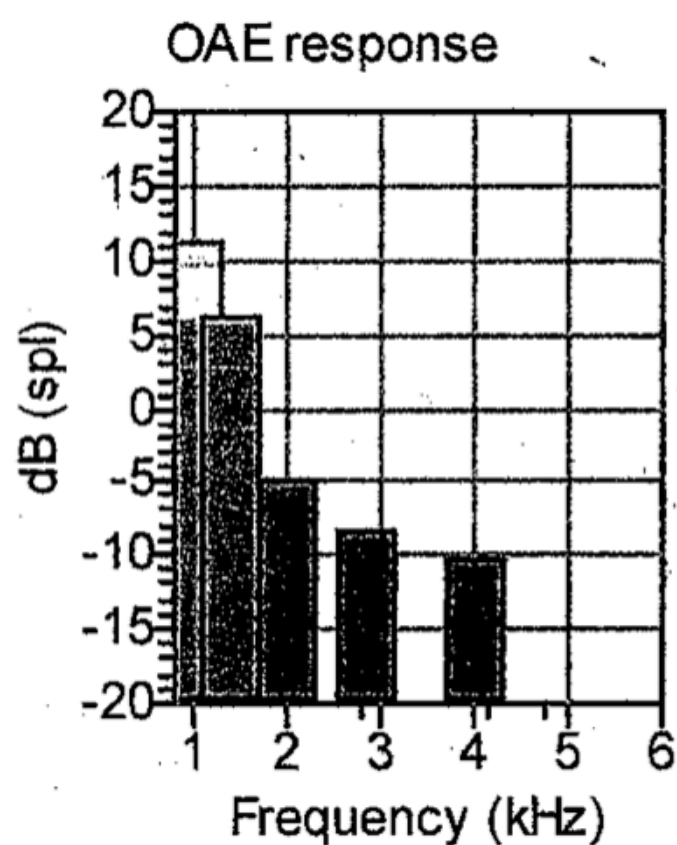
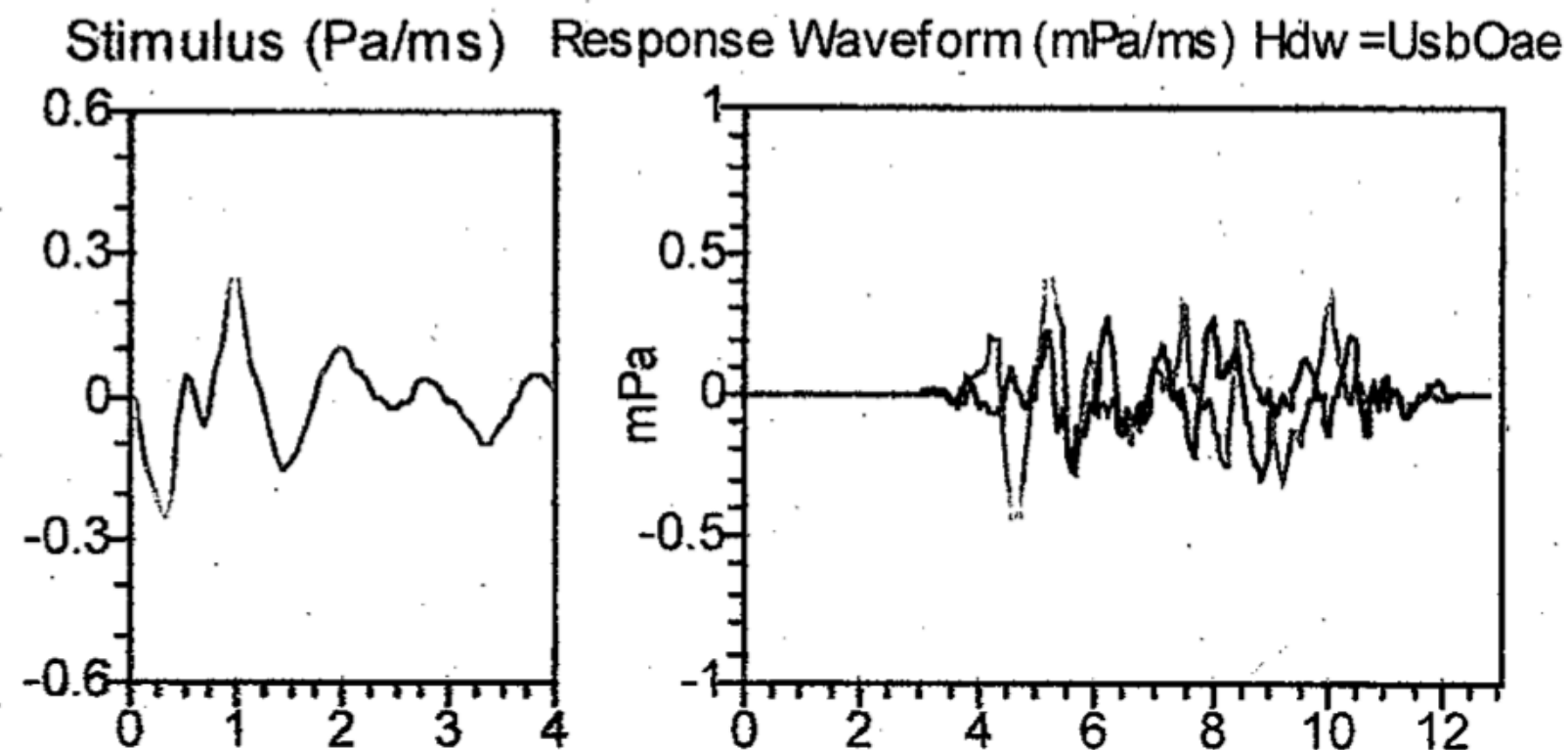
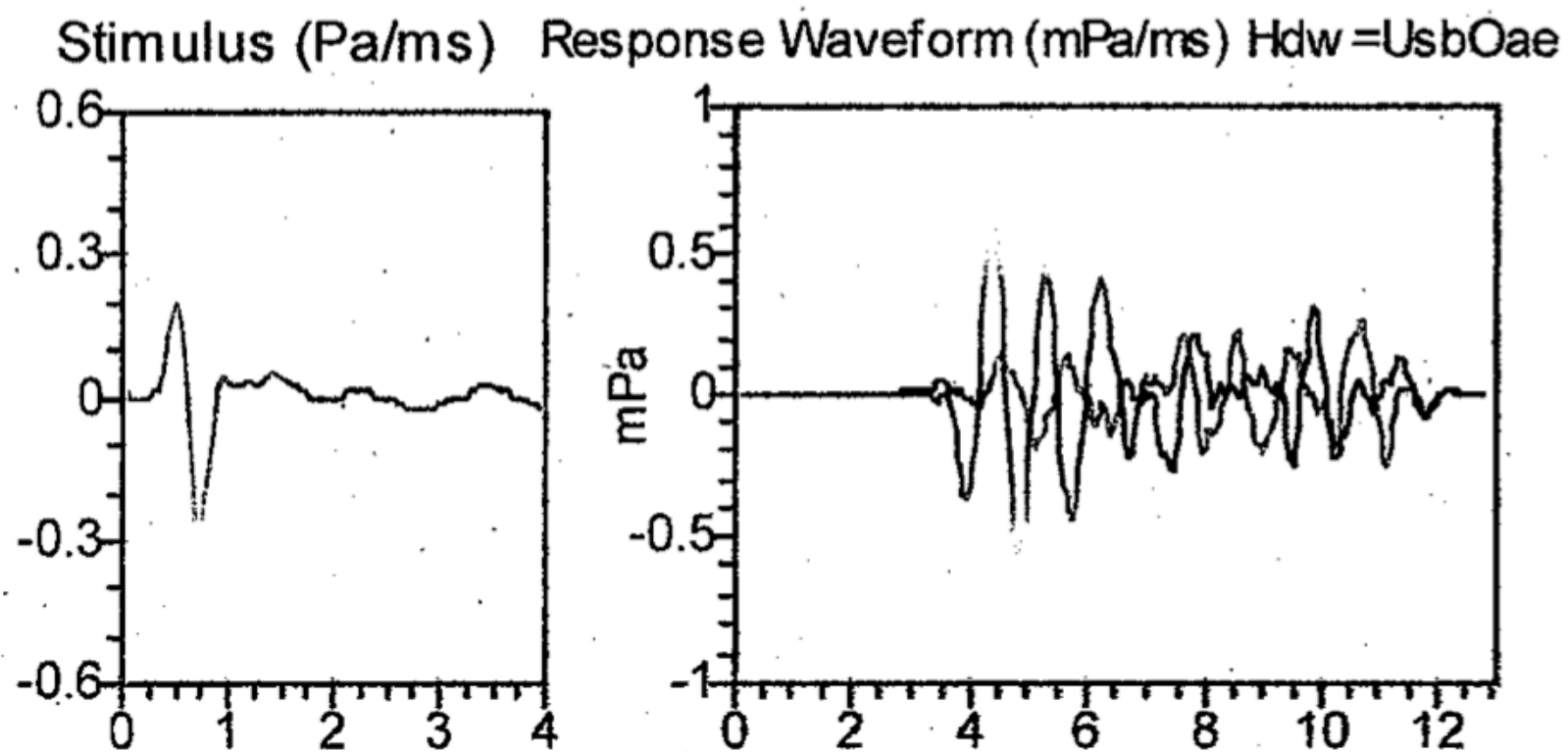
## Case 4

Please could you see this 5 week old baby who has recently recovered from bacterial meningitis. Mum has no concerns over his hearing at this time and he passed his newborn hearing screen prior to the meningitis

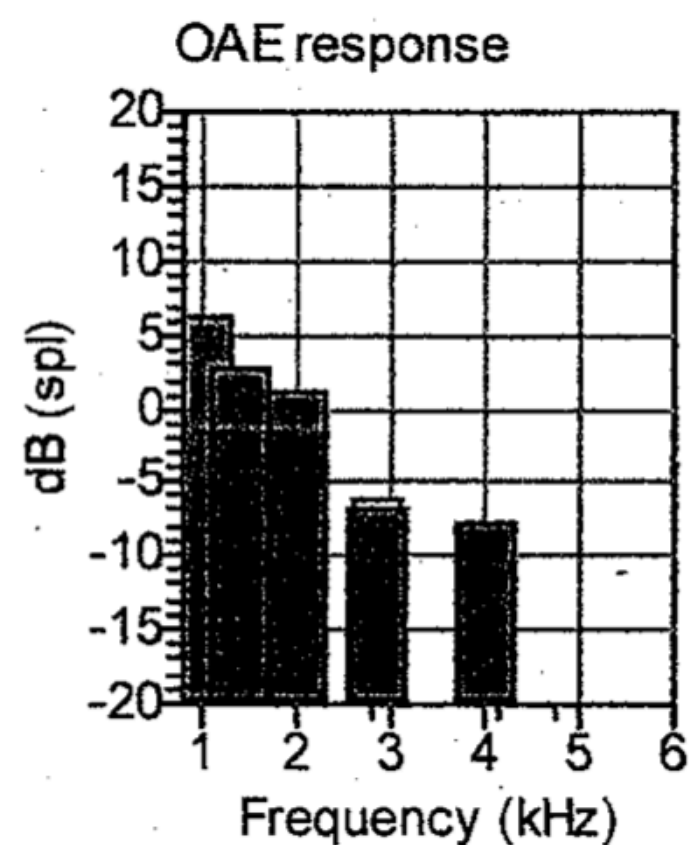
**Left ear**

NOTES:

**Right ear**



Half Octave Band Power		
Freq	SNR	Sig/Noise
1.0kHz	-10.5dB	0.8/11.3dB
1.4kHz	-4.6dB	1.6/6.3dB
2.0kHz	-7.3dB	-12.2/-4.9dB
2.8kHz	-6.0dB	-14.2/-8.2dB
4.0kHz	-3.3dB	-13.6/-10.3dB
NLo=109 NHi=1207 Stim=81.2dB		



Half Octave Band Power		
Freq	SNR	Sig/Noise
1.0kHz	-5.6dB	0.5/6.0dB
1.4kHz	-8.1dB	-5.5/2.6dB
2.0kHz	-6.4dB	-5.3/1.1dB
2.8kHz	0.8dB	-6.1/-6.9dB
4.0kHz	-3.3dB	-11.2/-7.9dB
NLo=61 NHi=721 Stim=81.9dB		

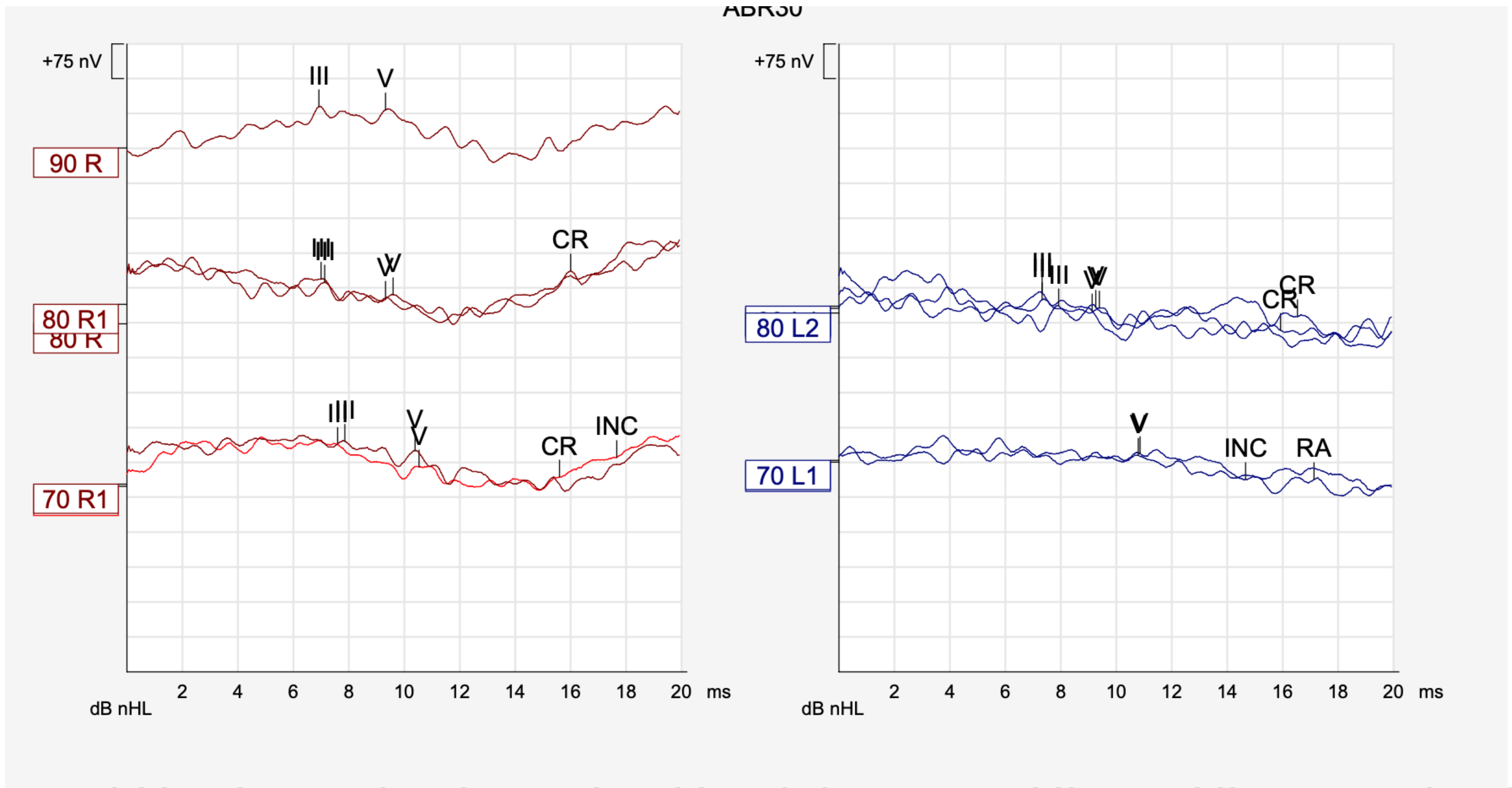
Test details	
Test type:	TE
Ear:	Left
Tester ID:	2
Date/Time of test:	09/03/2022 10:32:25
Data file name:	DF9W3930.DTA

**Result** Too noisy  
**Decision** Retest

Test details	
Test type:	TE
Ear:	Right
Tester ID:	2
Date/Time of test:	09/03/2022 10:39:19
Data file name:	DF9W3931.DTA

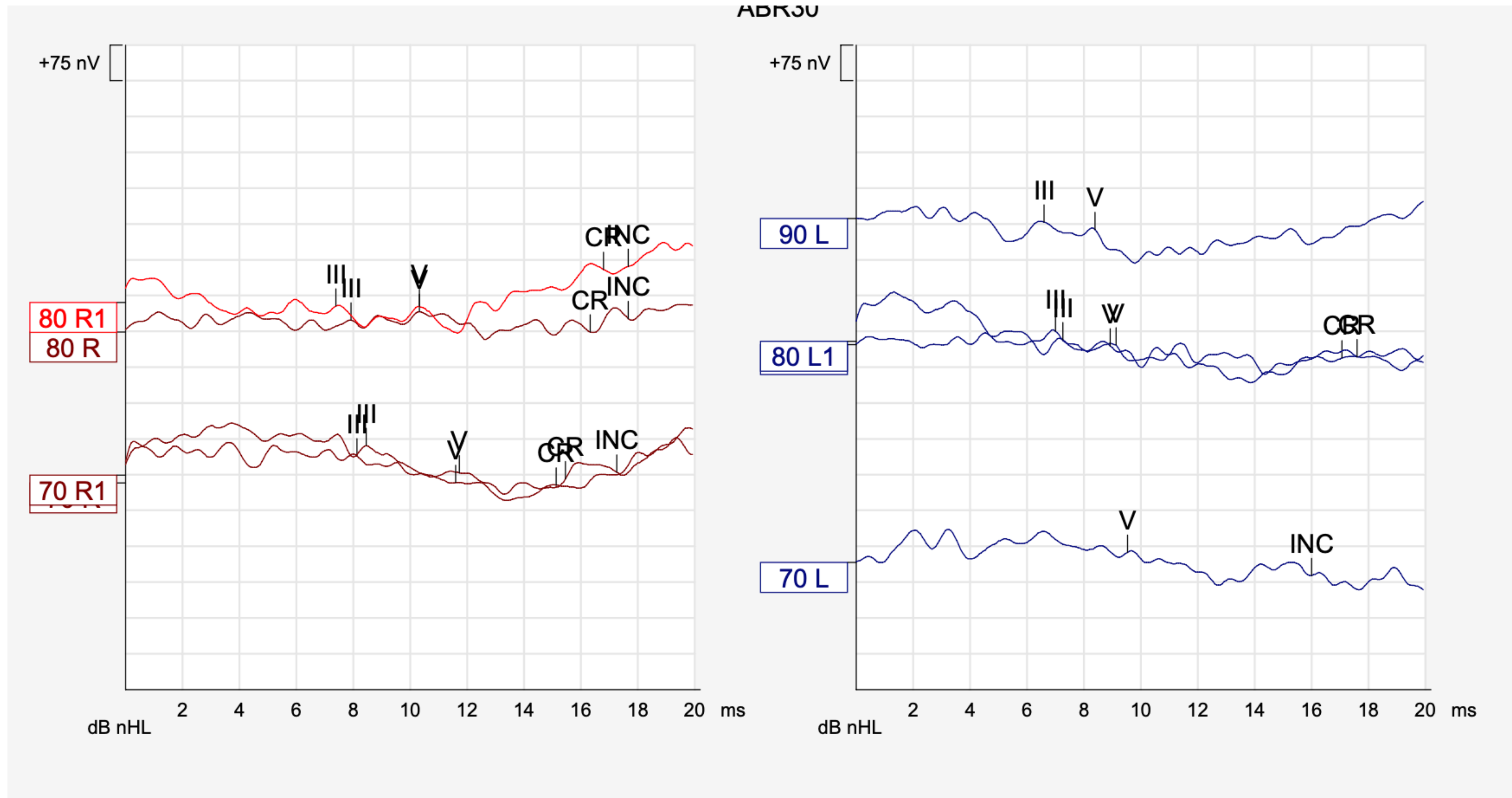
**Result** Too noisy  
**Decision** Retest





4kHz air conduction using Headphones - nHL to eHL correction is -10

What next?



1kHz air conduction using Headphones - nHL to eHL correction is -15

Child has woken up, what we telling parents?

## Case 5

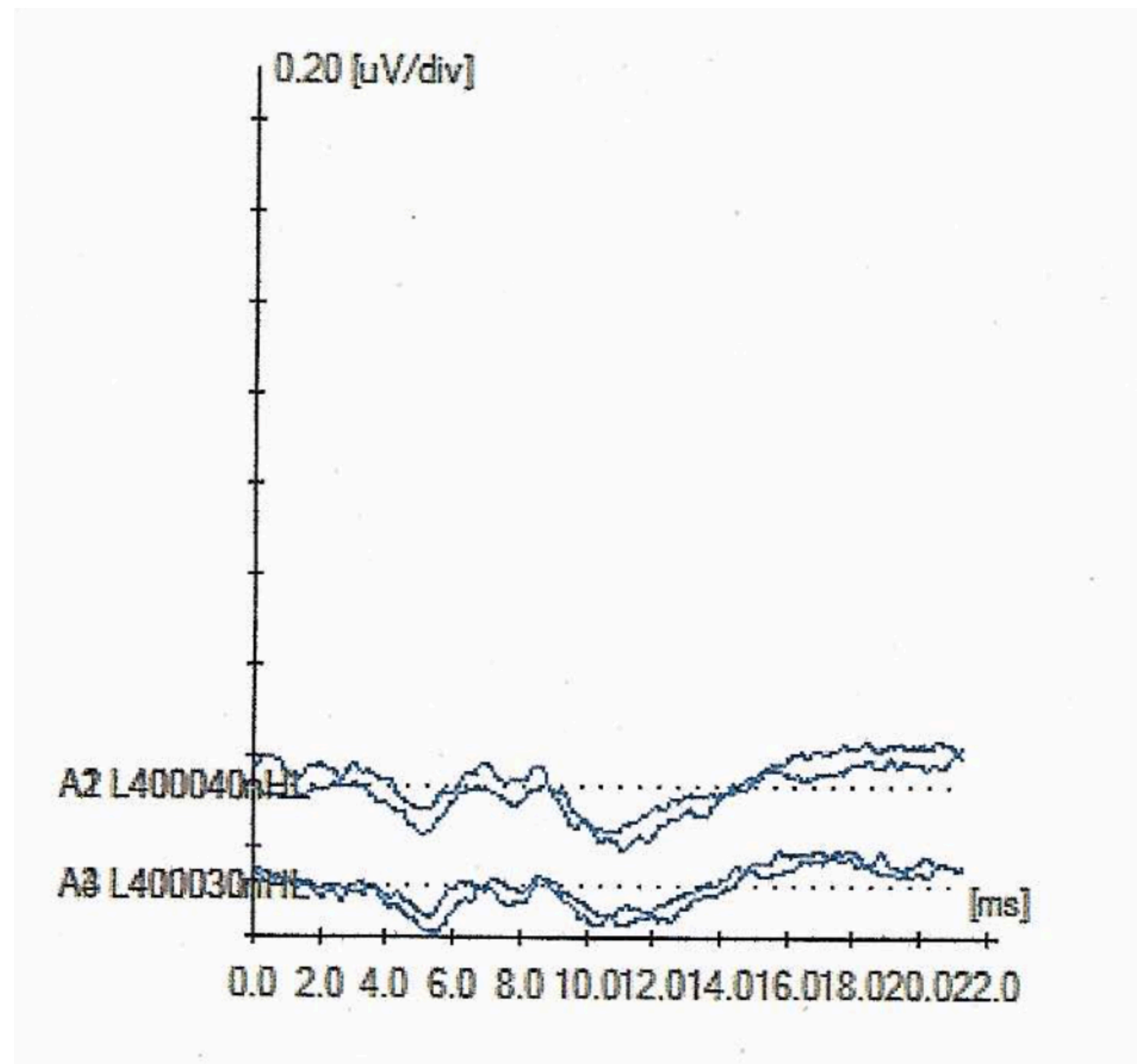
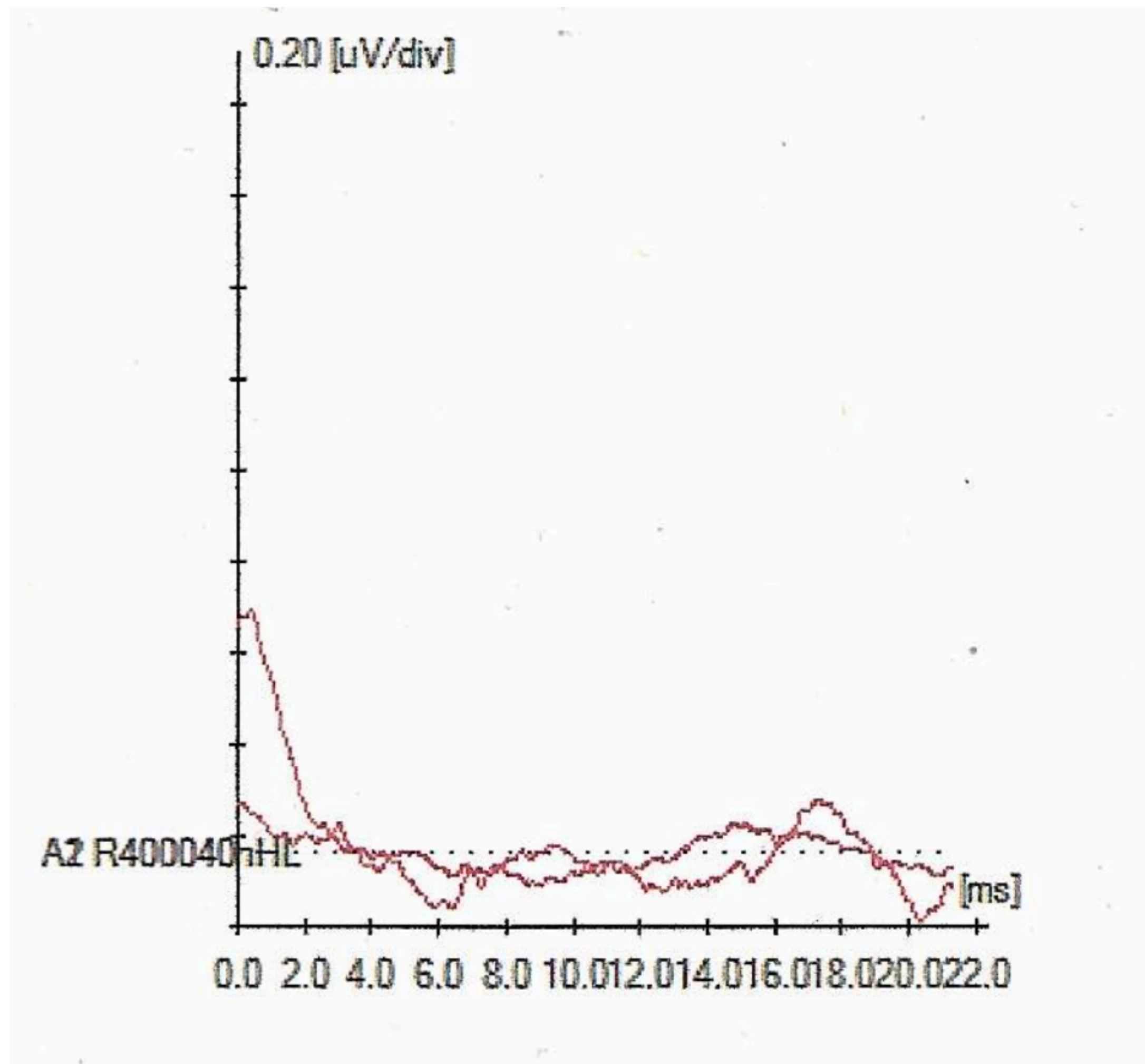
Please could you see this 3 week old baby who has bi-passed newborn hearing screening due to being diagnosed with cCMV

Mum has no concerns and is developing well

**OAE**

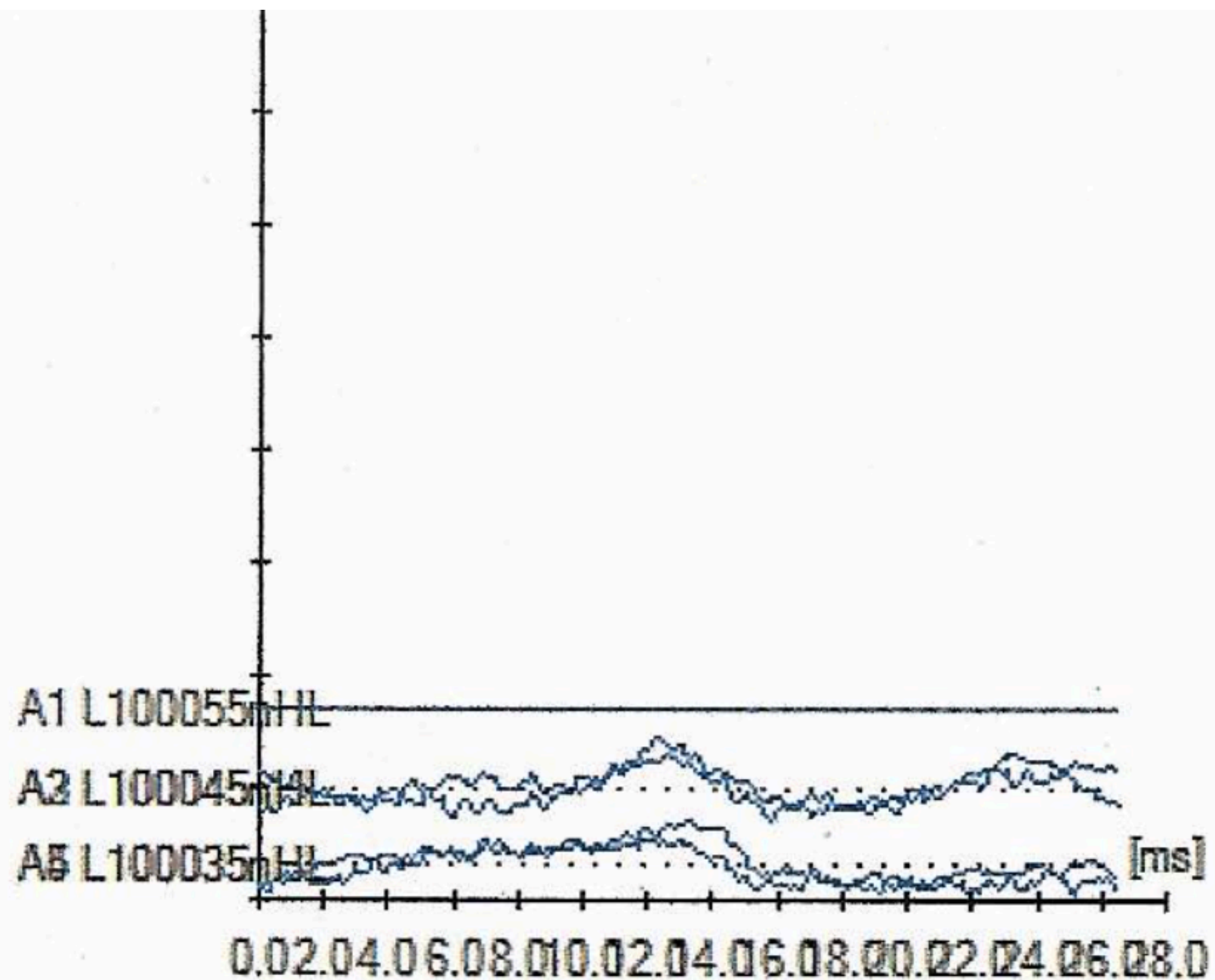
**Clear Response Left, all bands**

**Response Absent Right, all bands**



4kHz air conduction using Headphones - nHL to eHL correction is -10

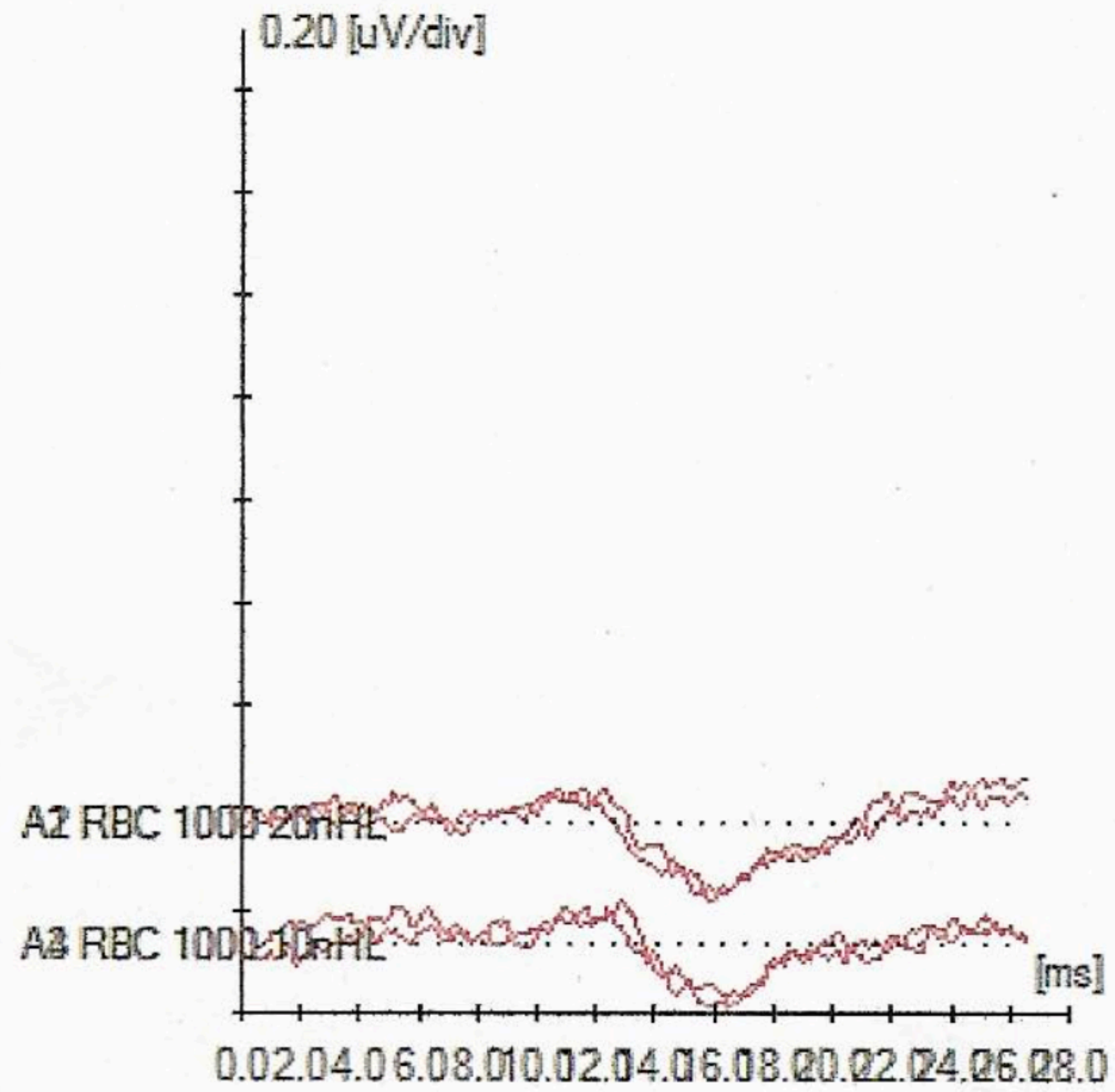
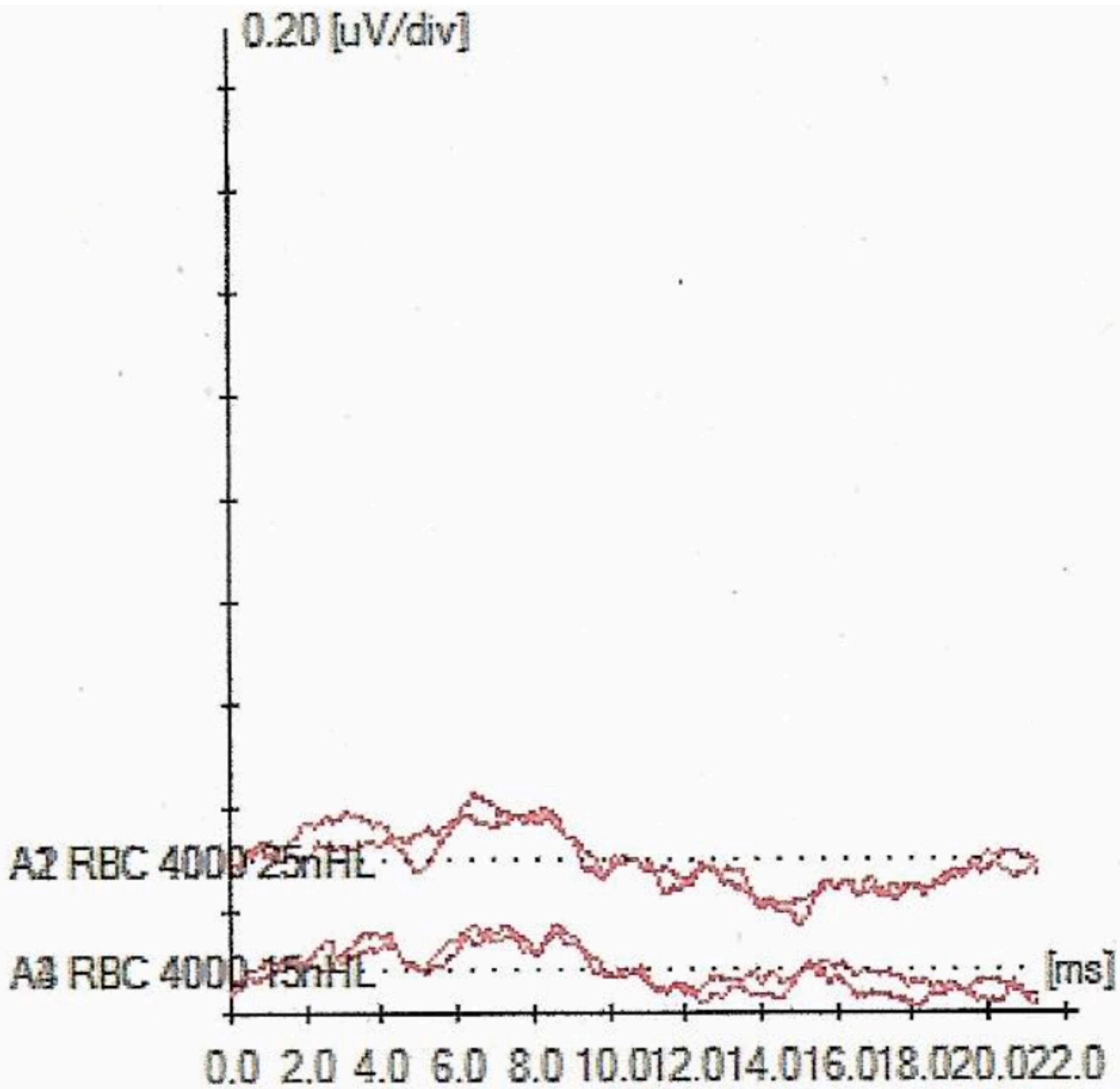
Child has woken up, but is looking sleepy, we've got another 2 hours left, what we doing next?



1kHz air conduction left using  
Headphones - nHL to eHL correction is  
-15

“This ear has an OAE, I should get  
normal and I want to ensure that the  
left ear is good, at worst then, I’ve got  
a unilateral PCHI and I know where I  
am for masking (if I need it)”

What next?



Going straight to BC, I need to know is this loss on the right conductive or sensory

Correction at this age is +5 at 1kHz and 0 at 4kHz

What next? What am I telling parents?

## Case 6

Please could you see this 3 week old well baby who has referred NHSP screening bilaterally

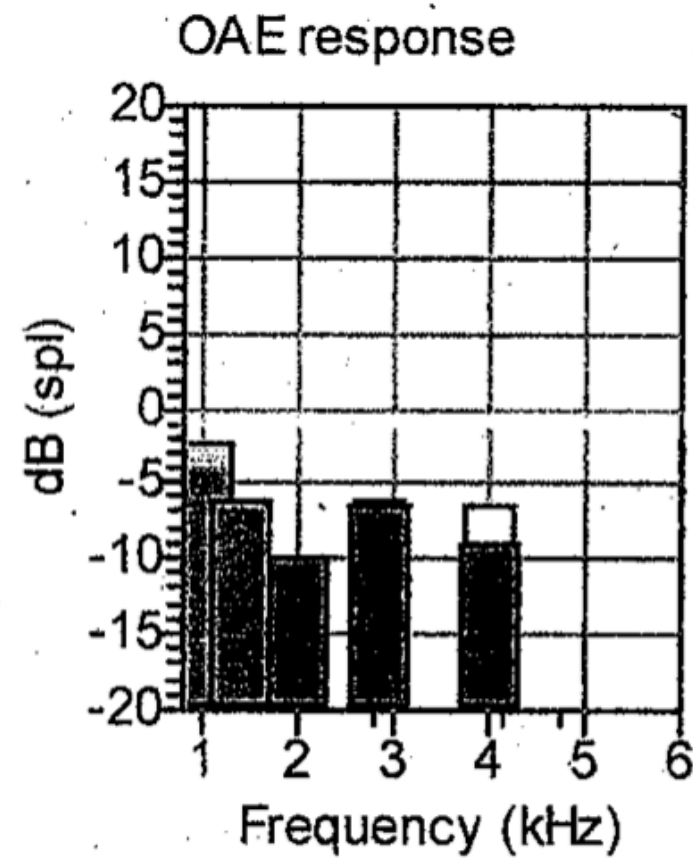
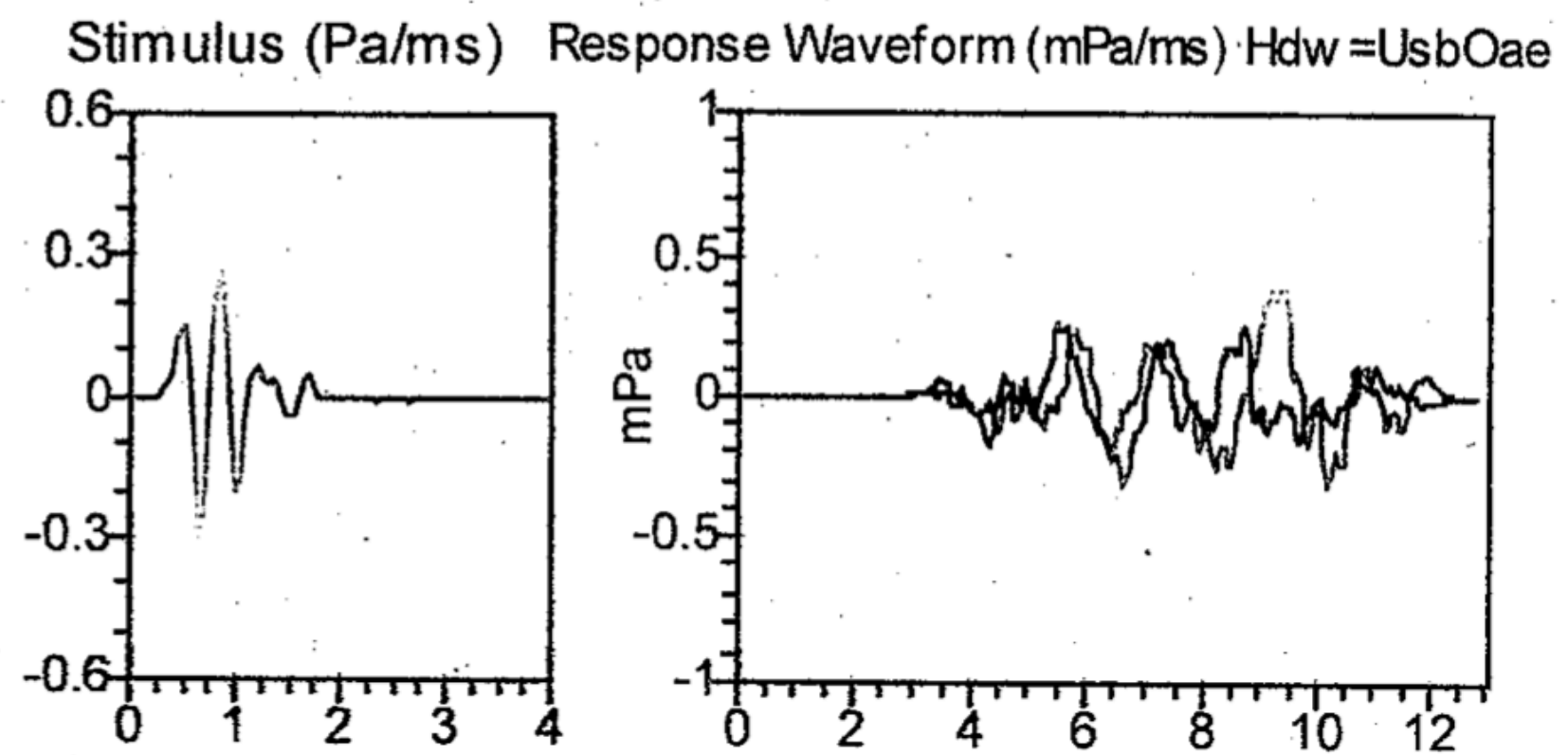
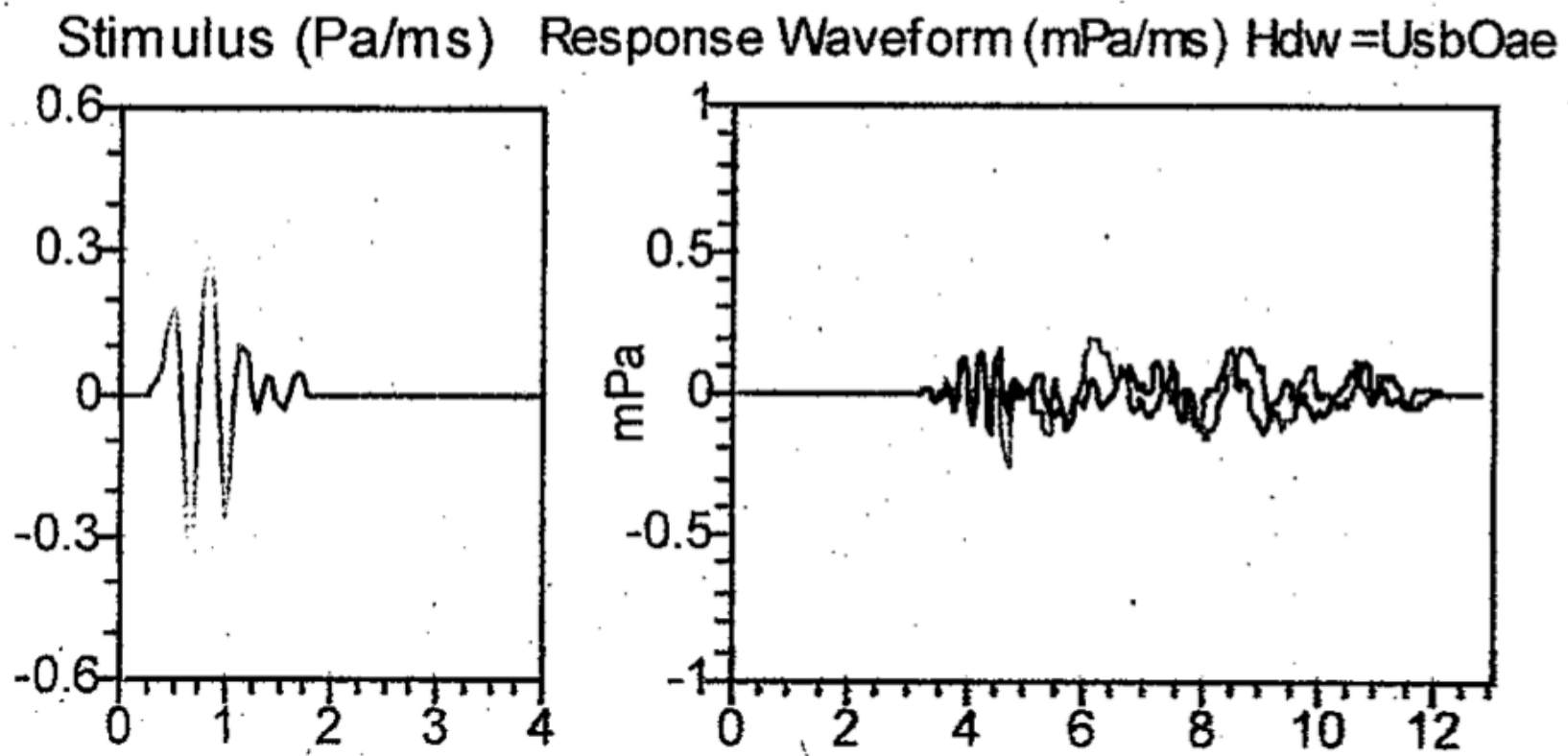
There is no significant history



**Left ear**

NOTES:

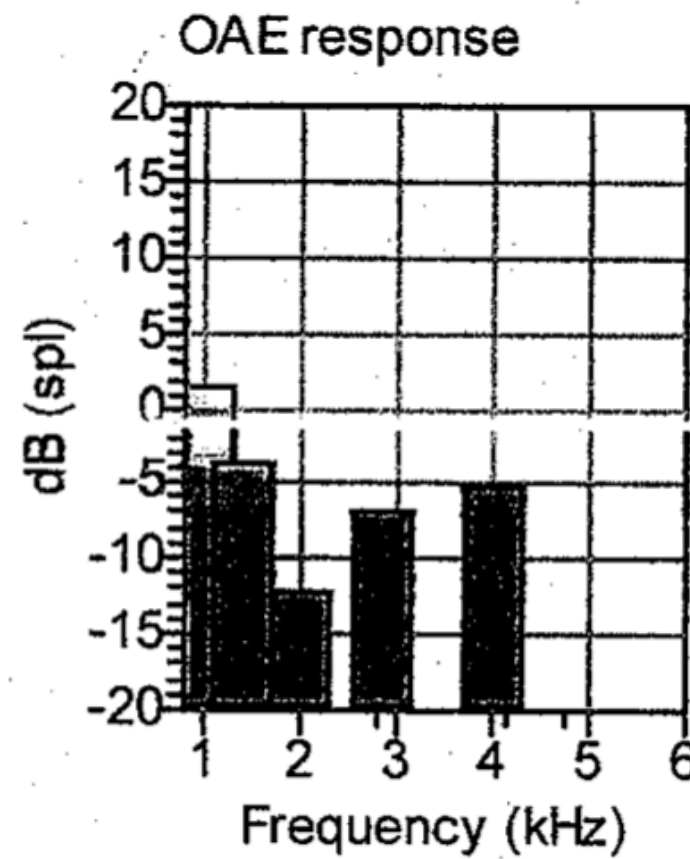
**Right ear**



Half Octave Band Power

Freq	SNR	Sig/Noise
1.0kHz	-3.0dB	-5.5/-2.5dB
1.4kHz	-9.0dB	-15.2/-6.2dB
2.0kHz	-4.7dB	-14.5/-9.6dB
2.8kHz	0.3dB	-6.2/-6.5dB
4.0kHz	2.7dB	-6.3/-9.1dB

NLo=260 NHi=379 Stim=84.0dB



Half Octave Band Power

Freq	SNR	Sig/Noise
1.0kHz	-8.8dB	-7.4/1.4dB
1.4kHz	-4.8dB	-8.4/-3.5dB
2.0kHz	-1.5dB	-13.5/-12.1dB
2.8kHz	-2.8dB	-9.6/-6.7dB
4.0kHz	-12.1dB	-17.4/-5.3dB

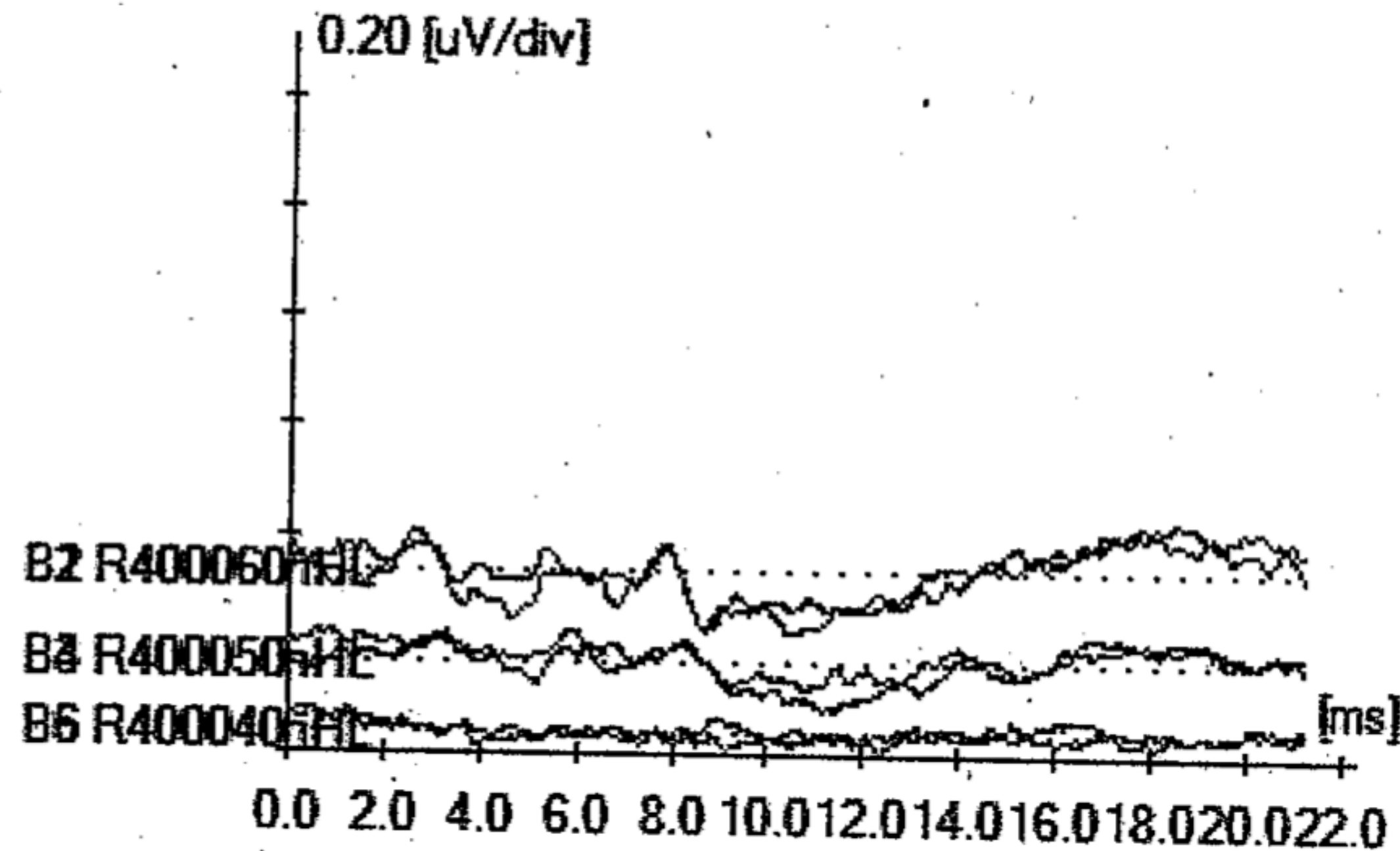
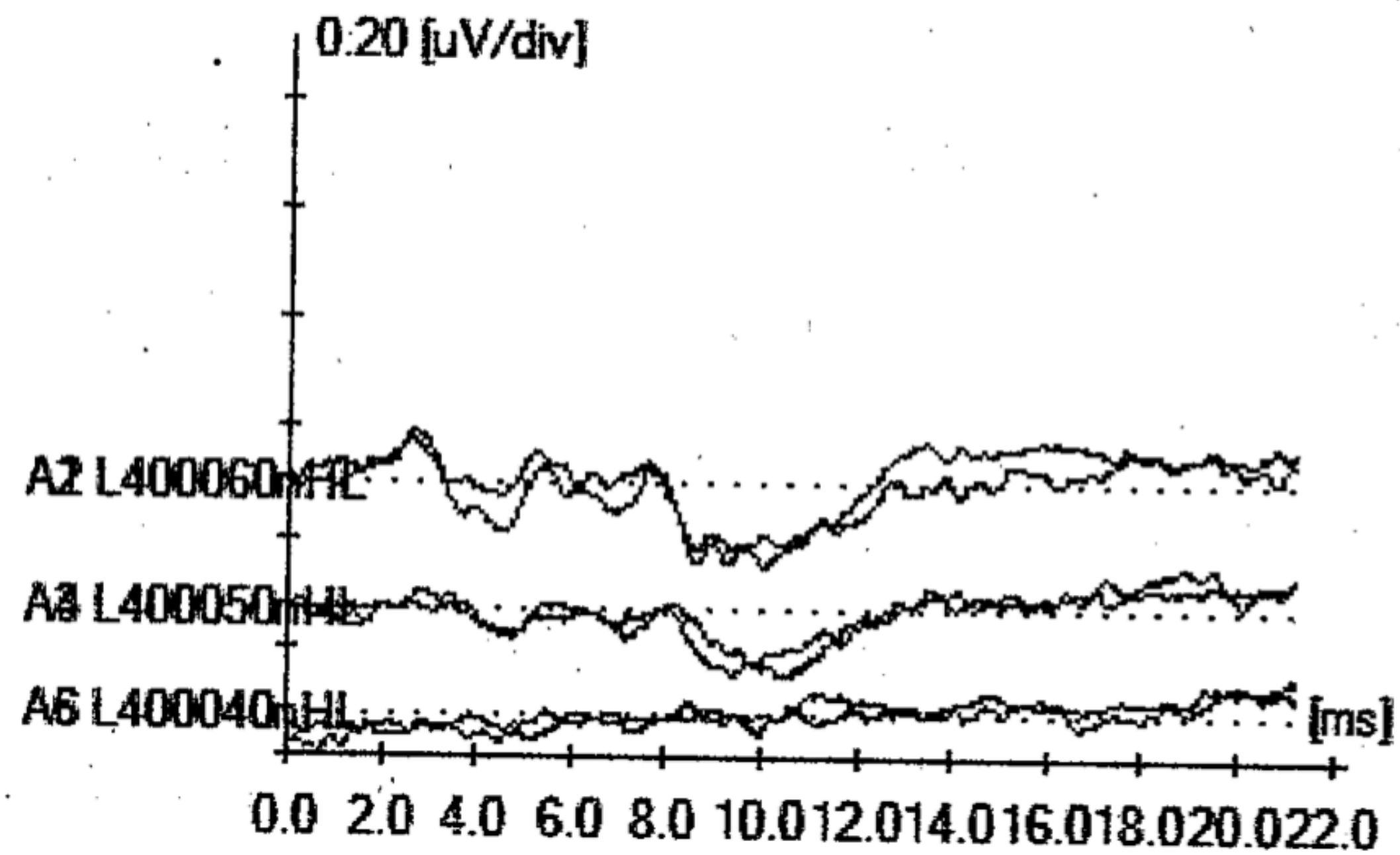
NLo=125 NHi=114 Stim=82.5dB

Test details	
Test type:	TE
Ear:	Left
Tester ID:	2

**Result** Re-test required  
**Decision** Retest

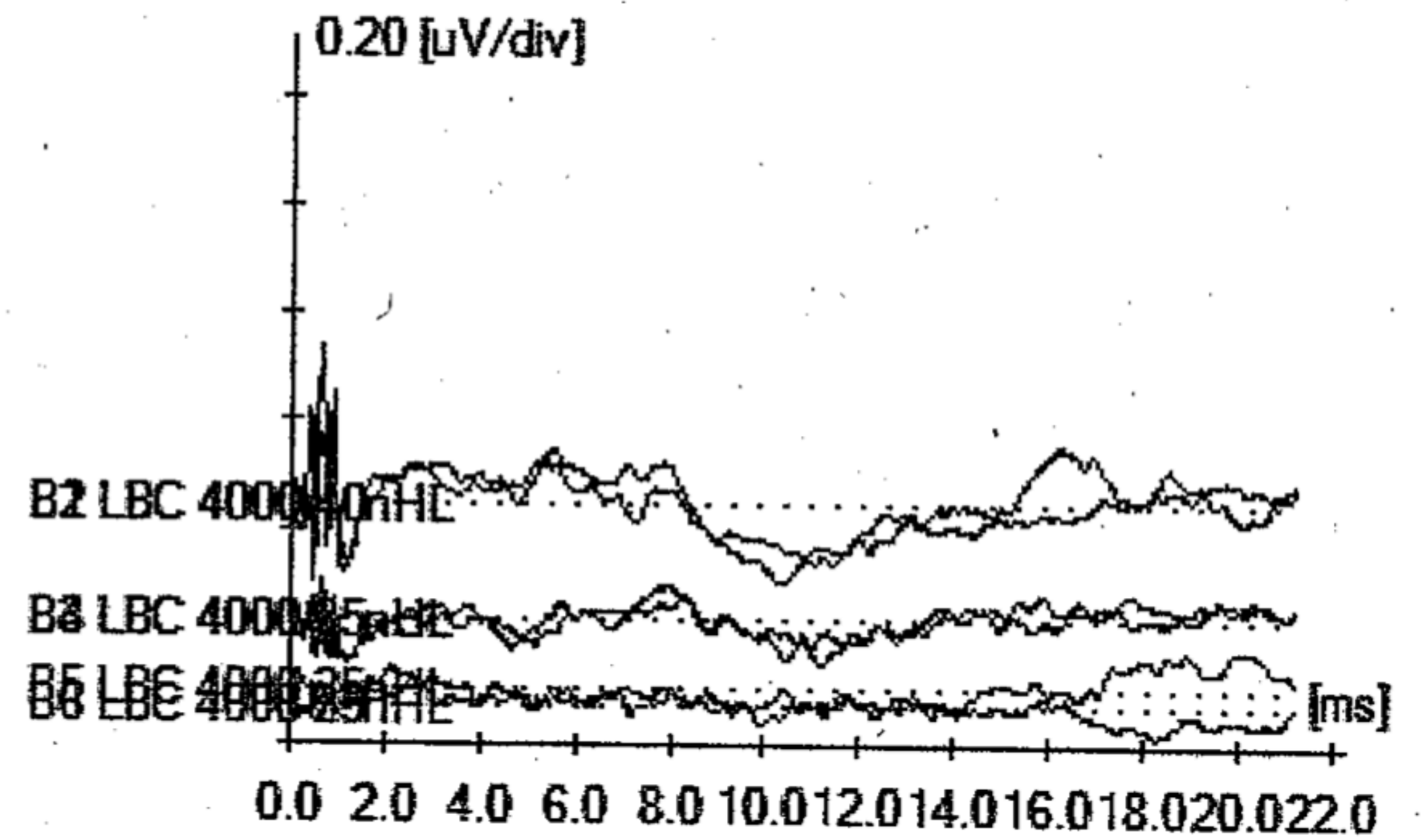
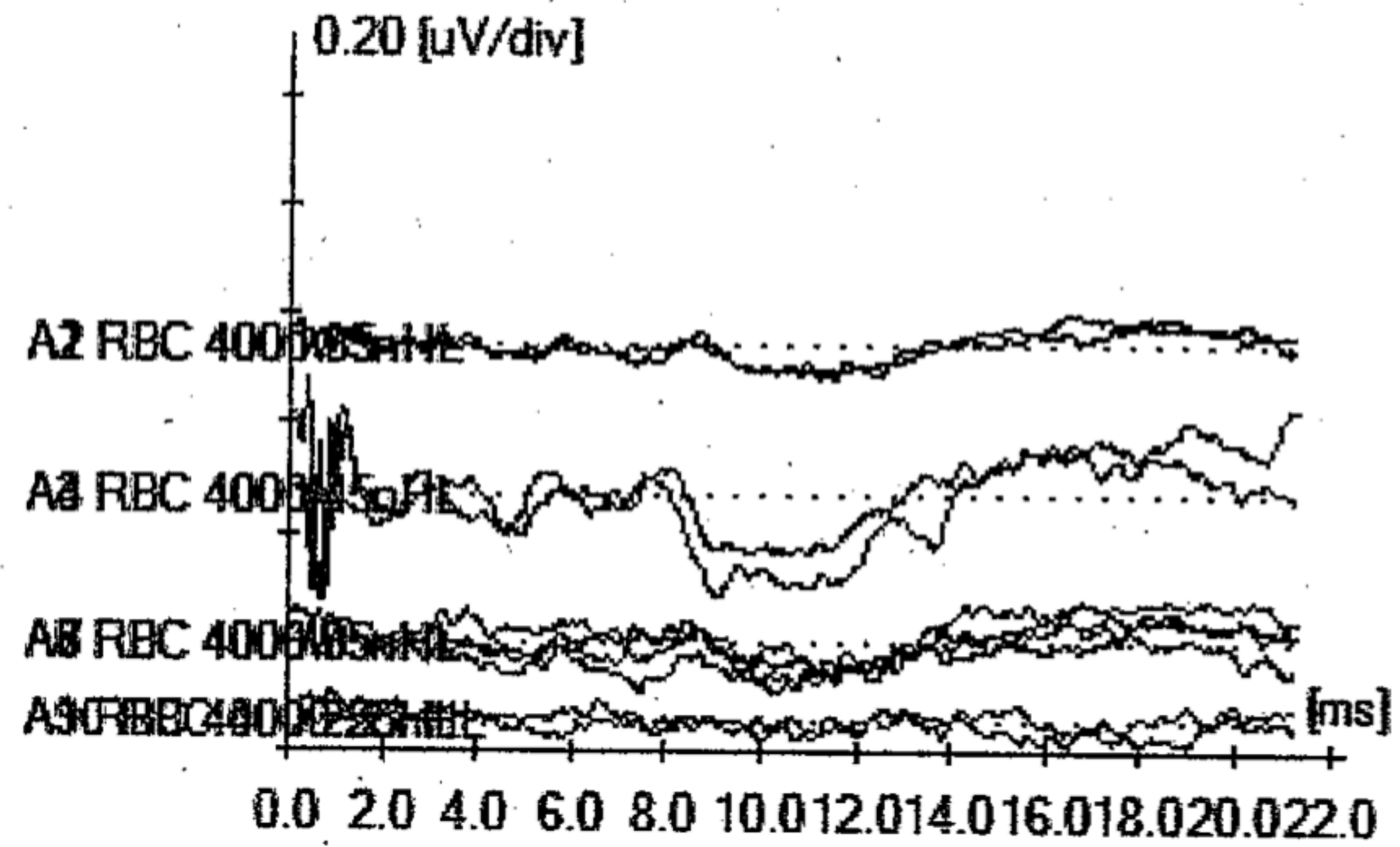
Test details	
Test type:	TE
Ear:	Right
Tester ID:	2

**Result** Re-test required  
**Decision** Retest



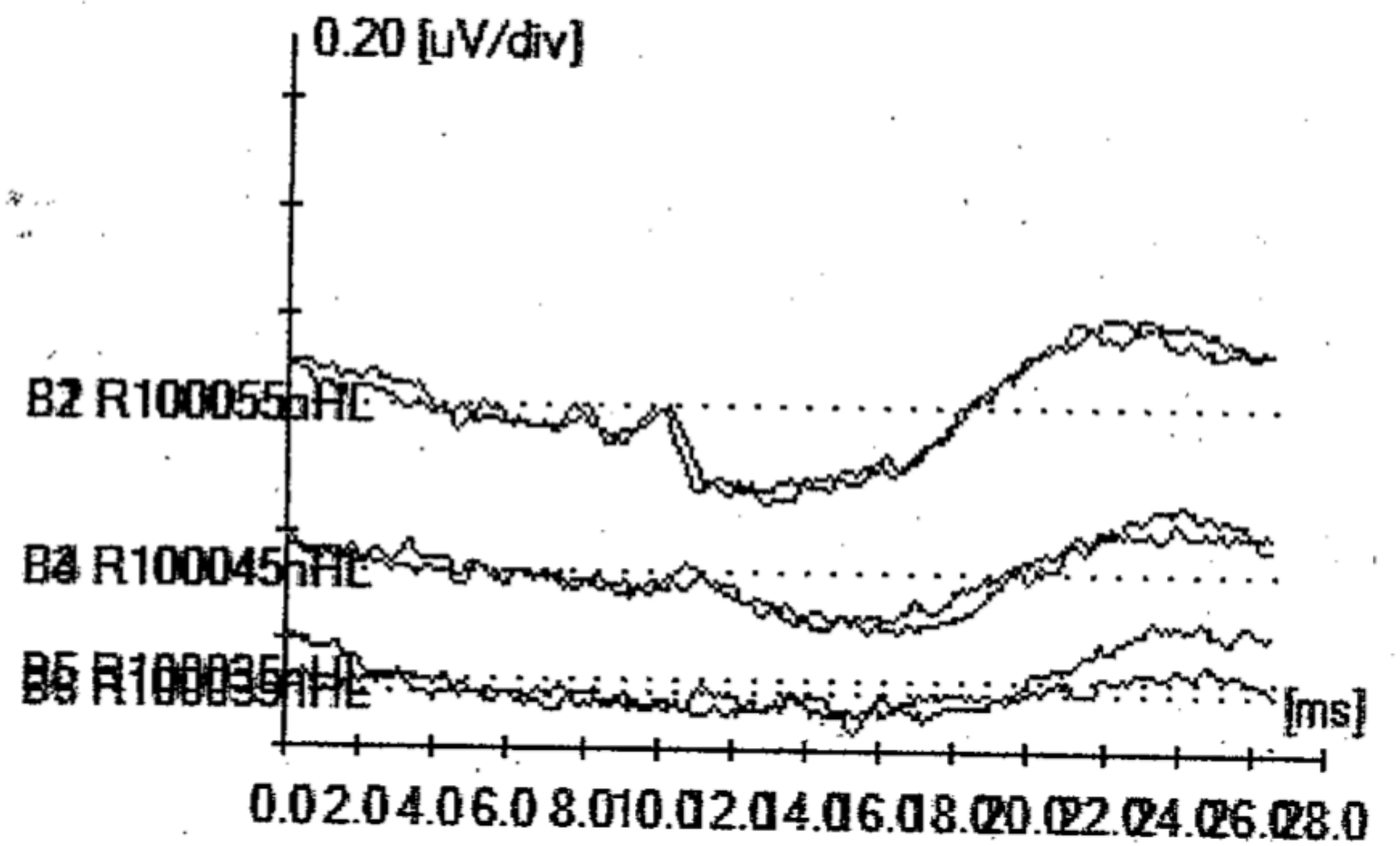
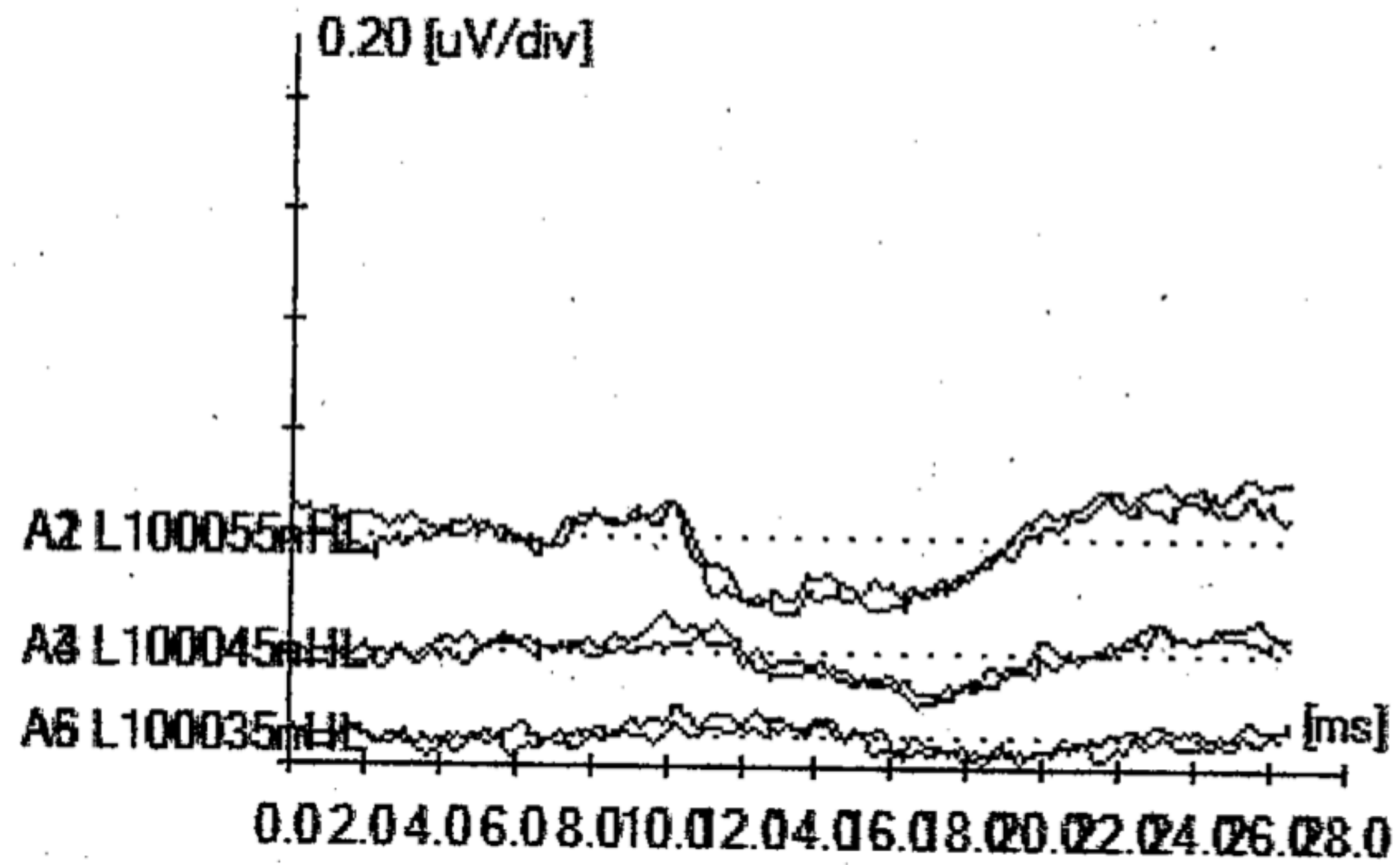
4kHz air conduction using Headphones - nHL to eHL correction is -10

What next?



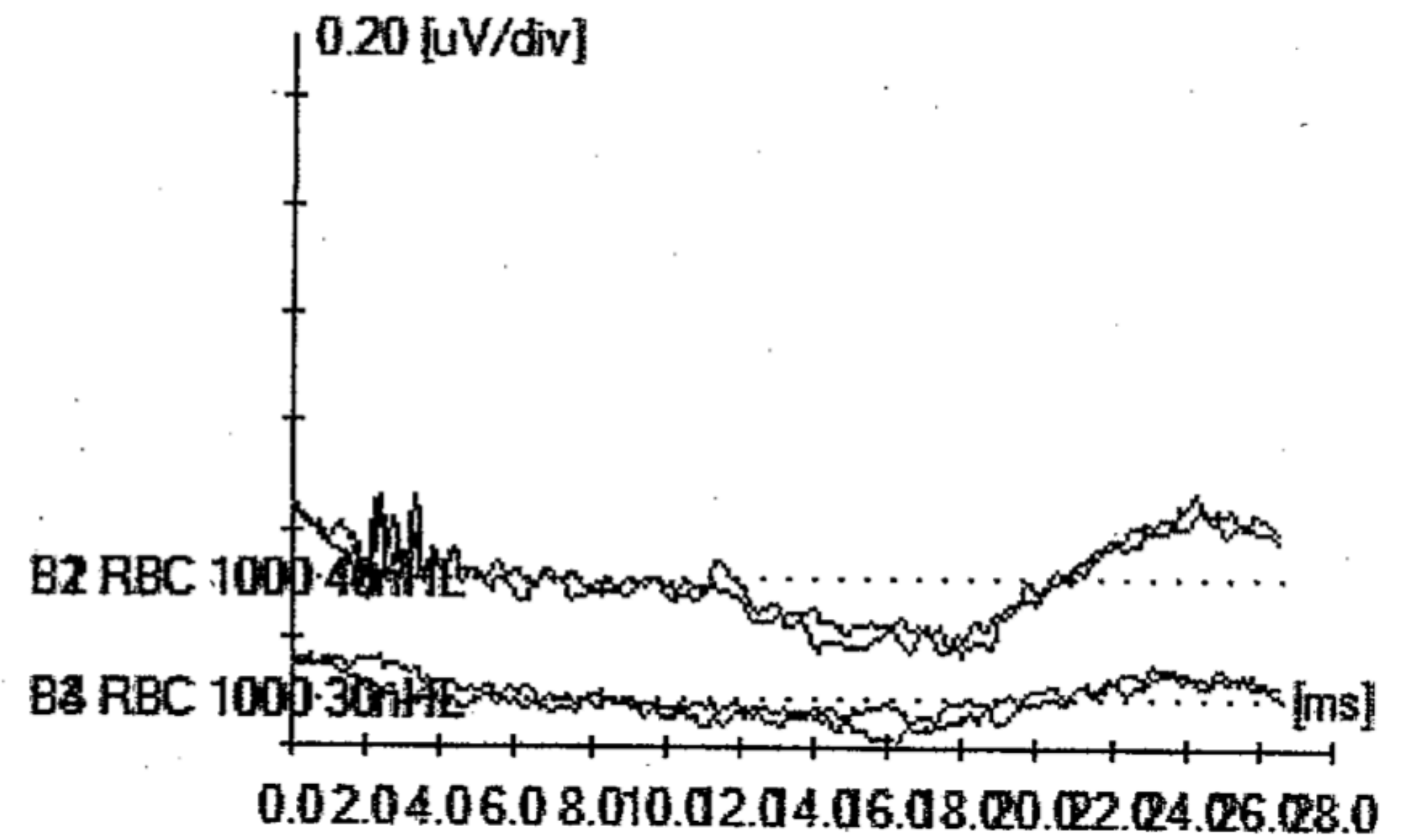
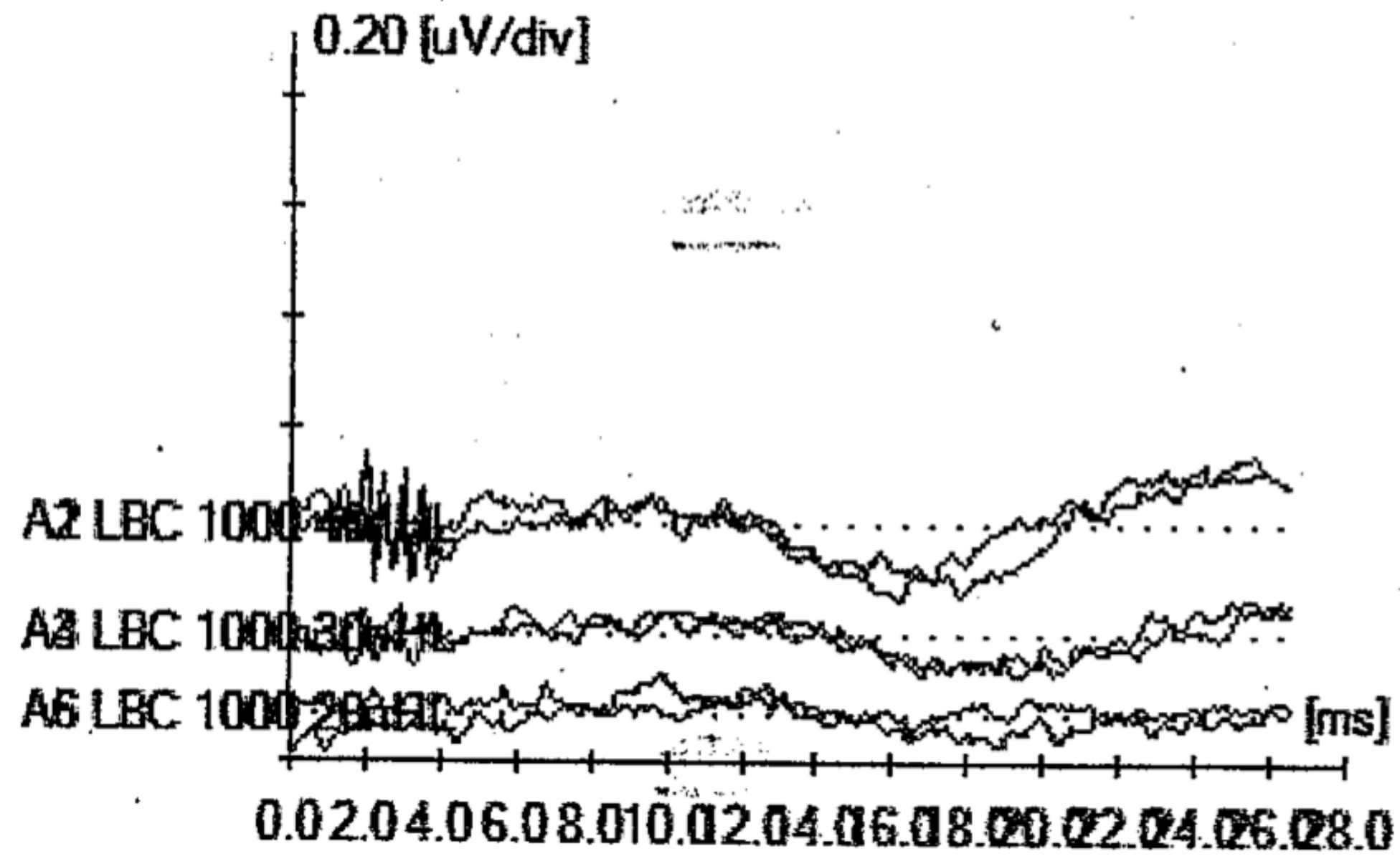
4kHz bone conduction - correction is 0

What next?



1kHz air conduction - correction is -15

What next?



1kHz bone conduction - correction is +5

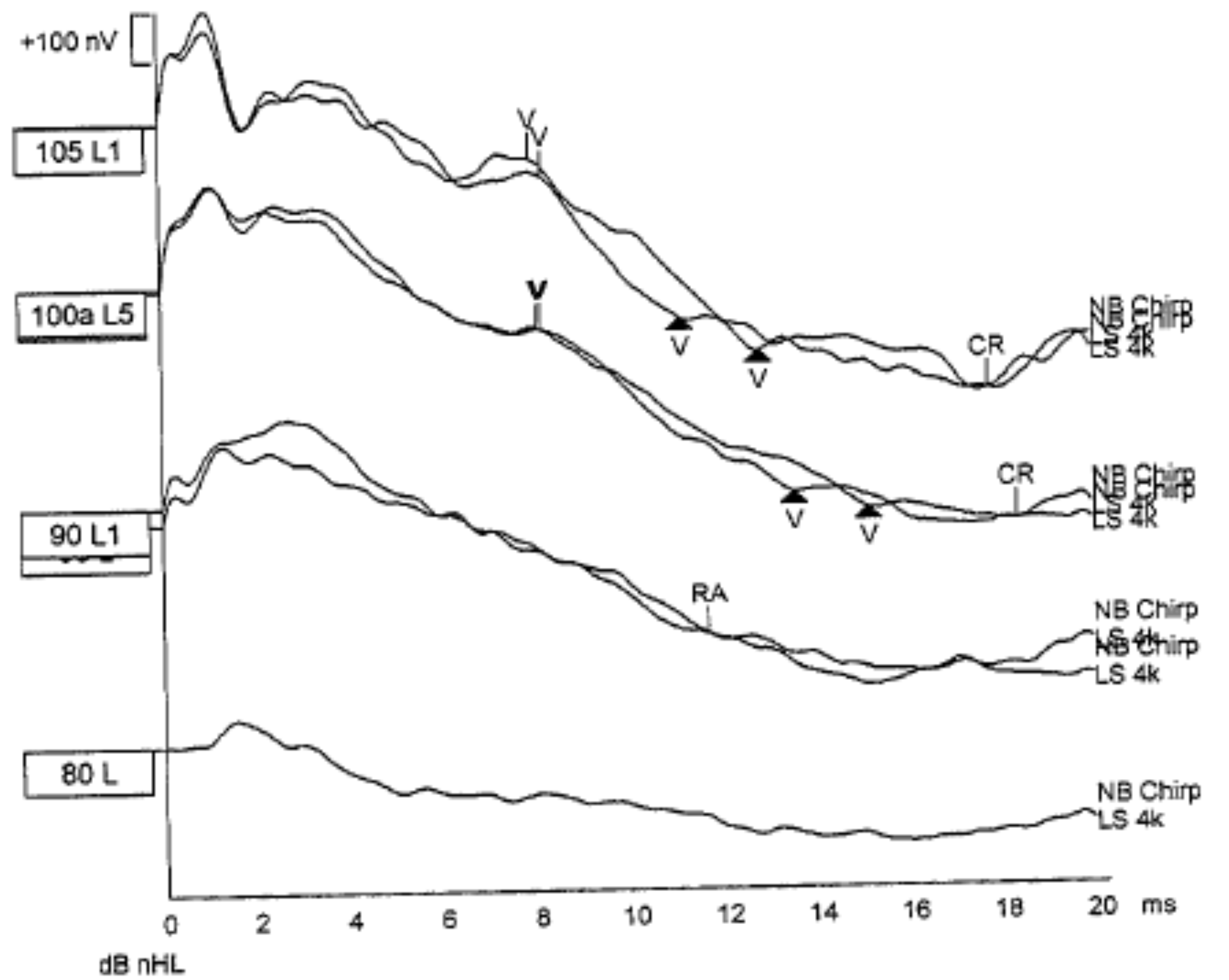
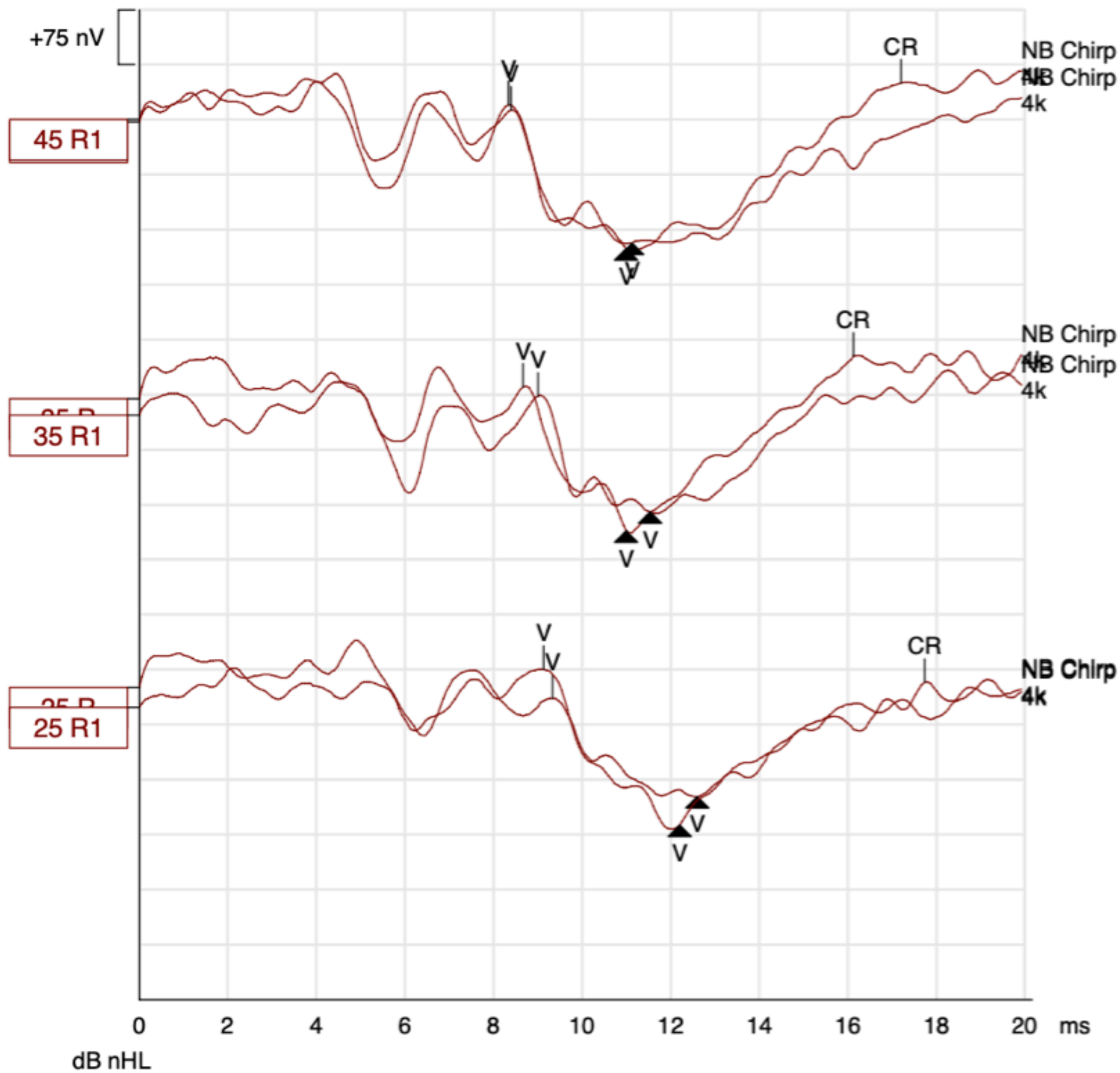
What next? Management?

## Case 7

Please could you see this 4 week old unilateral well baby referral from NHSP for more testing

There is no significant history

Your colleague has seen this baby and hands you this set of results, saying they're not sure what they are looking at

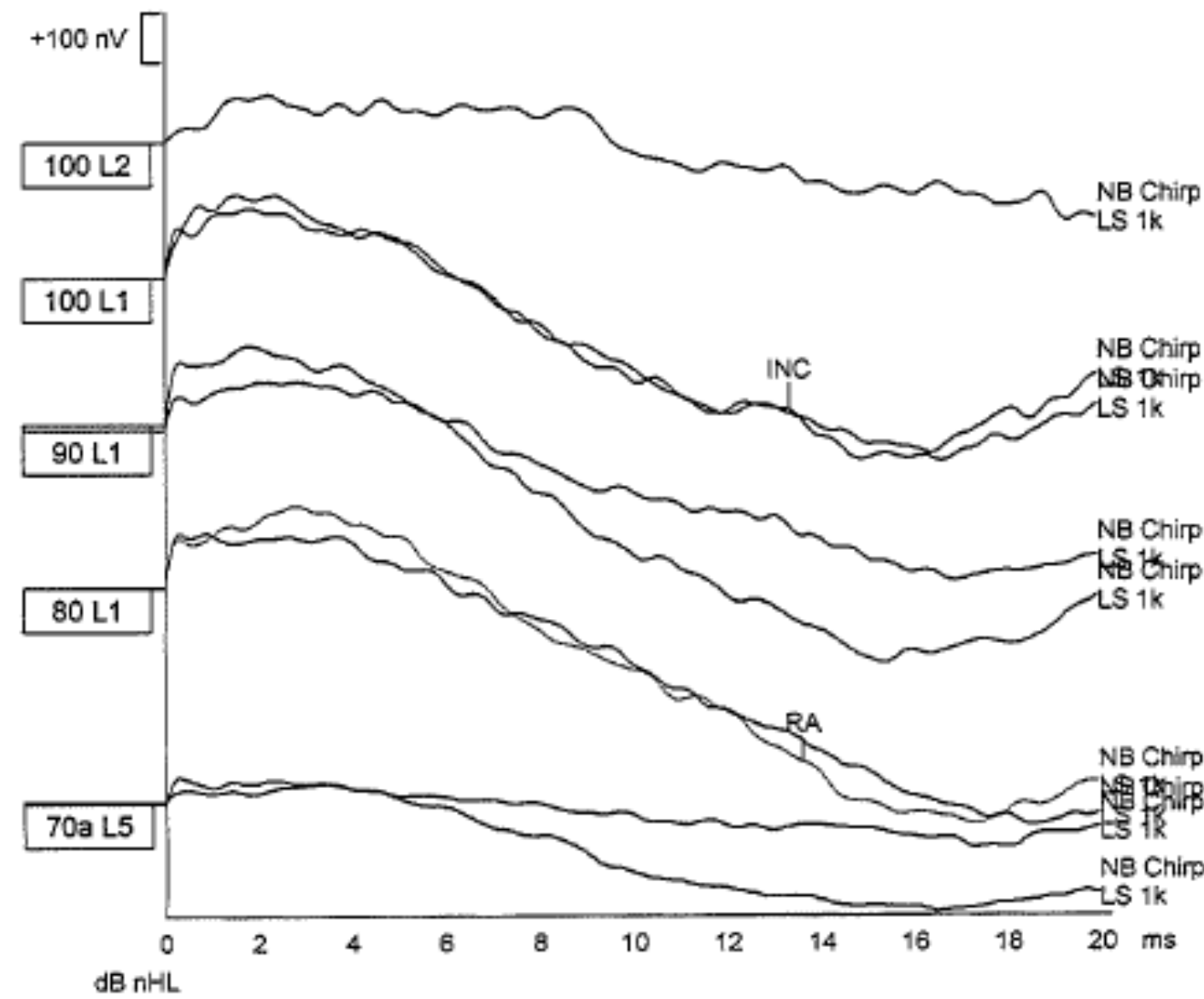
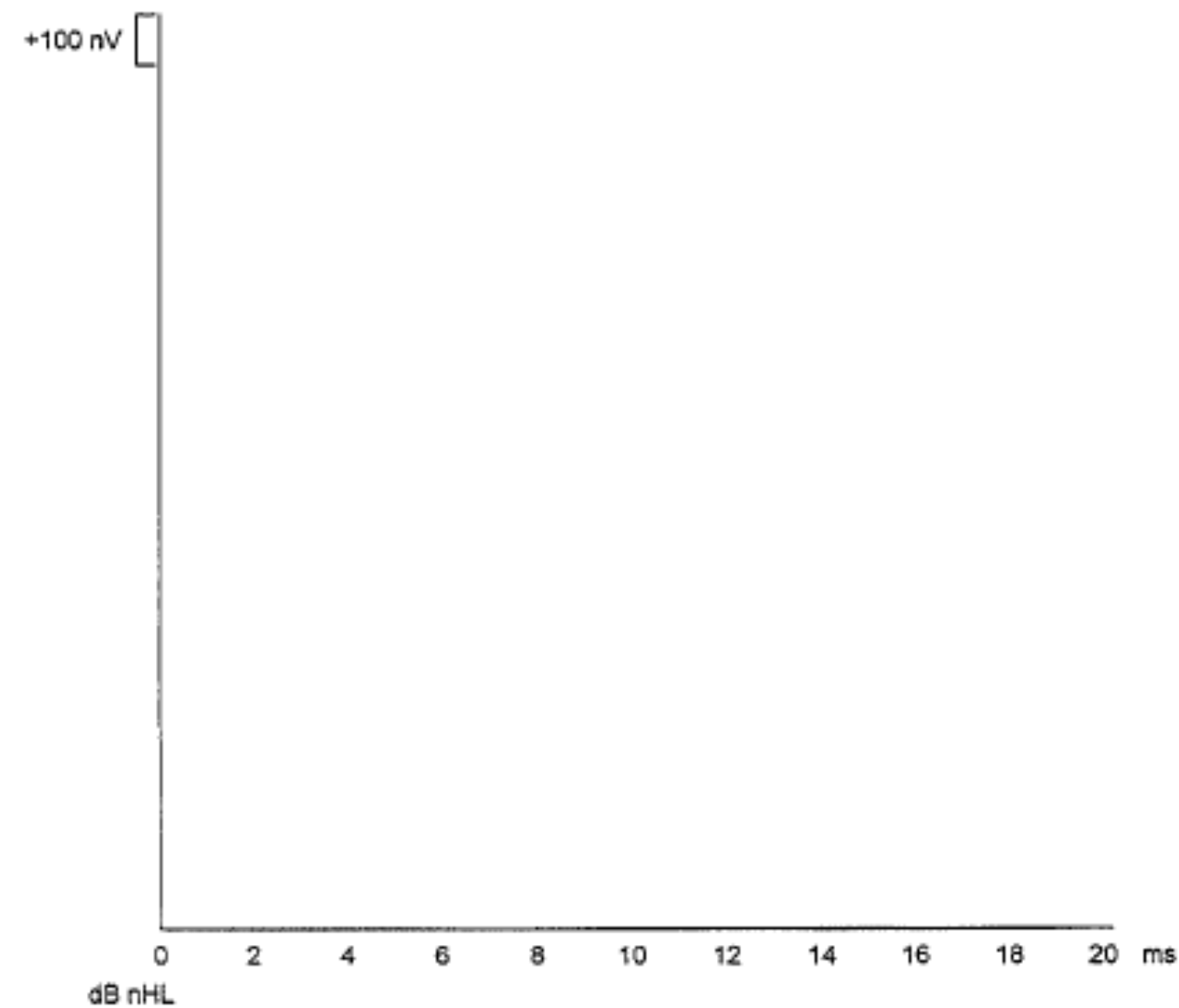


4kHz air conduction using Headphones - nHL to eHL correction is -5

What do we think?

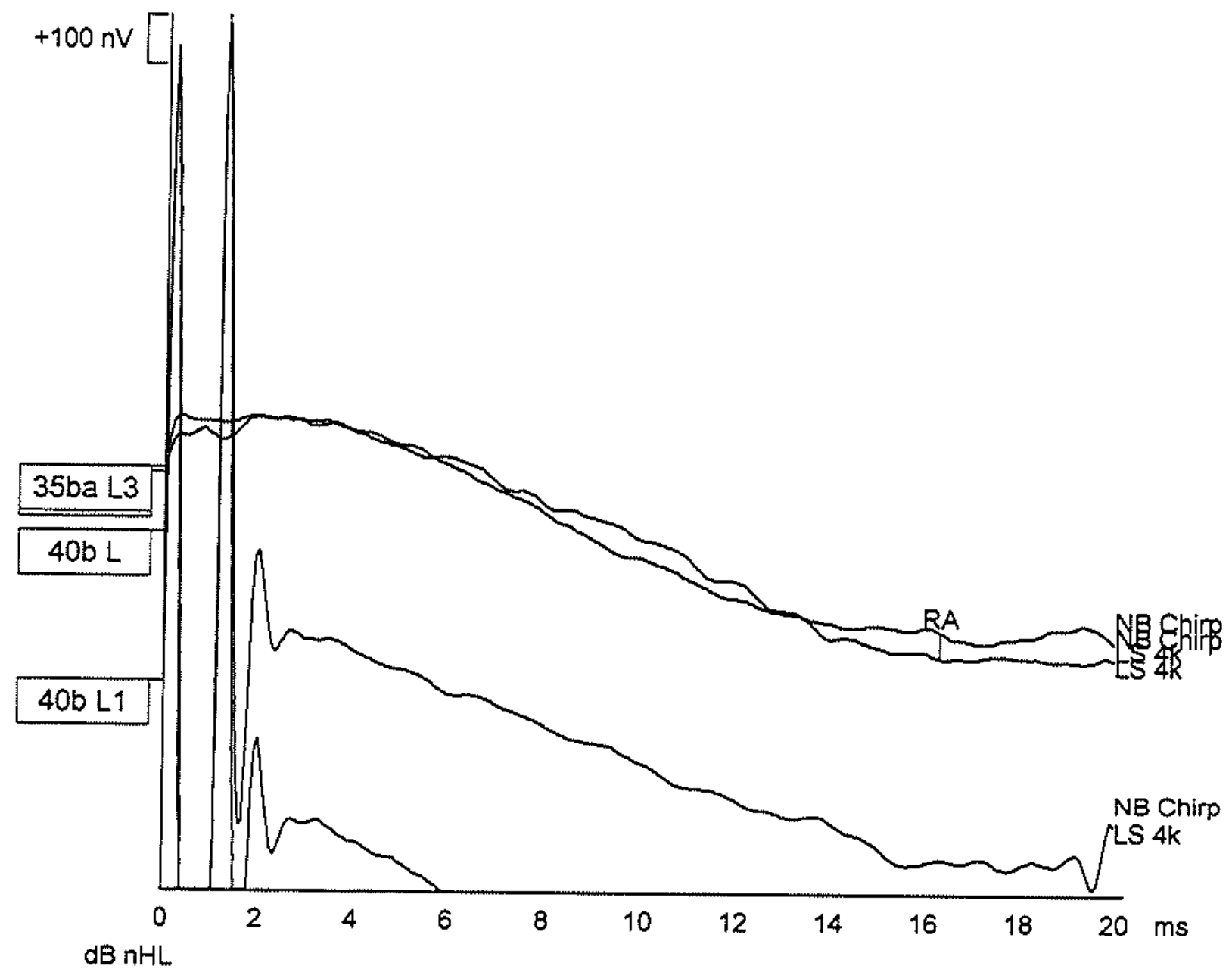
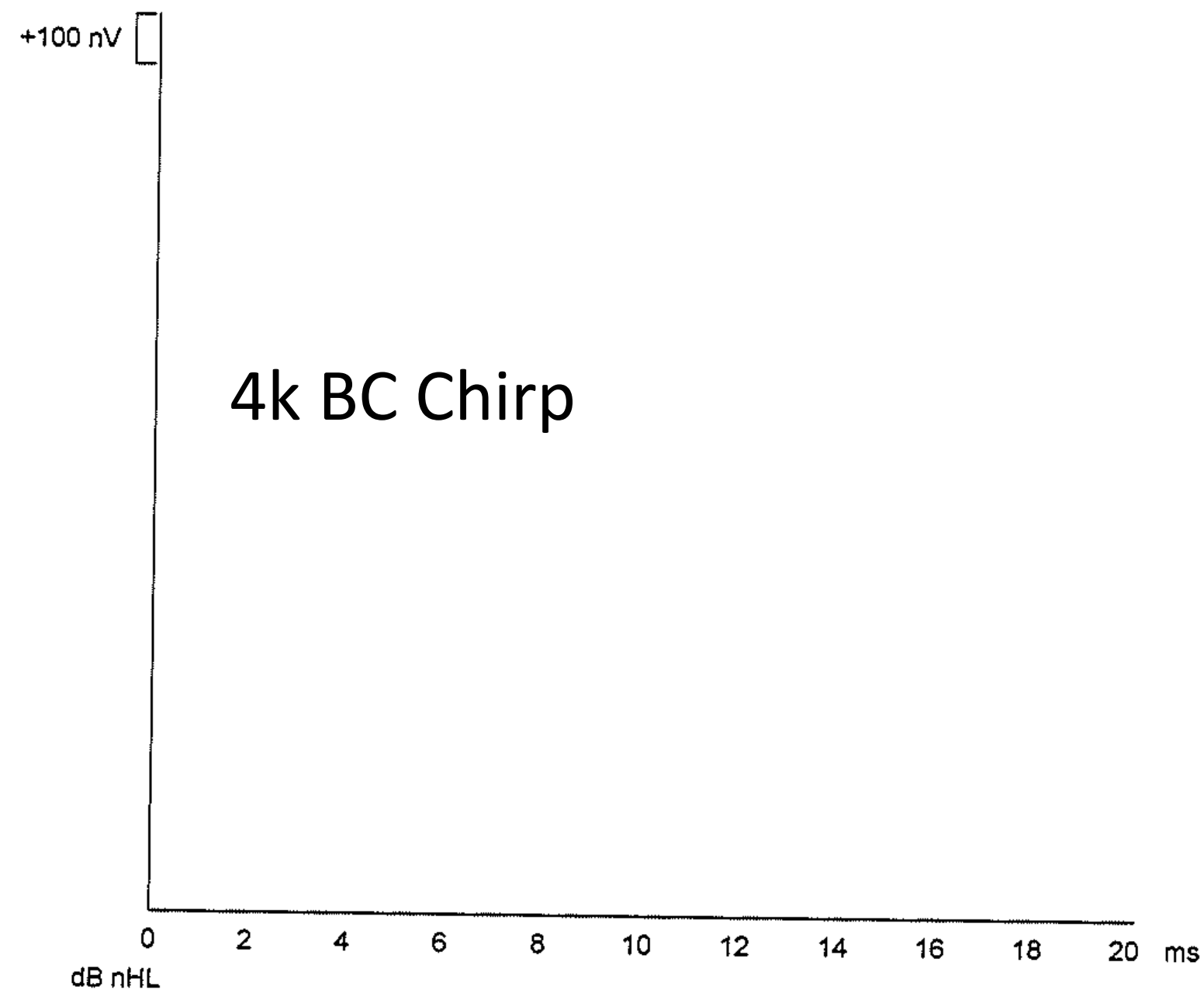
# 1k AC Chirp

Curve	Recorded Rejected	Reject. Ivl.( $\mu$ V)	Masking	Wave Repro	Stimuli/ sec	Display		Ratio Resp. Ampl. RN	Polarity	Window	Freq.	Sine waves	Rise/Fall	Plateau
						Low Pass	High Pass							
<b>100 L</b> Ver 4.5.1.4 HPF:33 Hz 6/oct LPF:1500 Hz Headphone Bayesian	4000 7%	[ $\pm$ 40] $\pm$ 9.8	80 dB SPL	99 %	39.1	1.5kHz	None	— — 13nV	NB CE-Chirp® LS Alt.	N/A	1000 Hz	N/A	N/A	N/A
<b>100 L1</b> Ver 4.5.1.4 HPF:33 Hz 6/oct LPF:1500 Hz Headphone Bayesian	4000 8%	[ $\pm$ 40] $\pm$ 9.8	80 dB SPL	96 %	39.1	1.5kHz	None	— — 16nV	NB CE-Chirp® LS Alt.	N/A	1000 Hz	N/A	N/A	N/A
<b>100 L2</b> Ver 4.5.1.4 HPF:33 Hz 6/oct LPF:1500 Hz Headphone Bayesian	2800 3%	[ $\pm$ 40] $\pm$ 9.8	80 dB SPL	60 %	39.1	1.5kHz	None	— — 21nV	NB CE-Chirp® LS Alt.	N/A	1000 Hz	N/A	N/A	N/A
<b>90 L</b> Ver 4.5.1.4 HPF:33 Hz 6/oct LPF:1500 Hz Headphone Bayesian	4000 7%	[ $\pm$ 40] $\pm$ 9.8	70 dB SPL	99 %	39.1	1.5kHz	None	— — 14nV	NB CE-Chirp® LS Alt.	N/A	1000 Hz	N/A	N/A	N/A

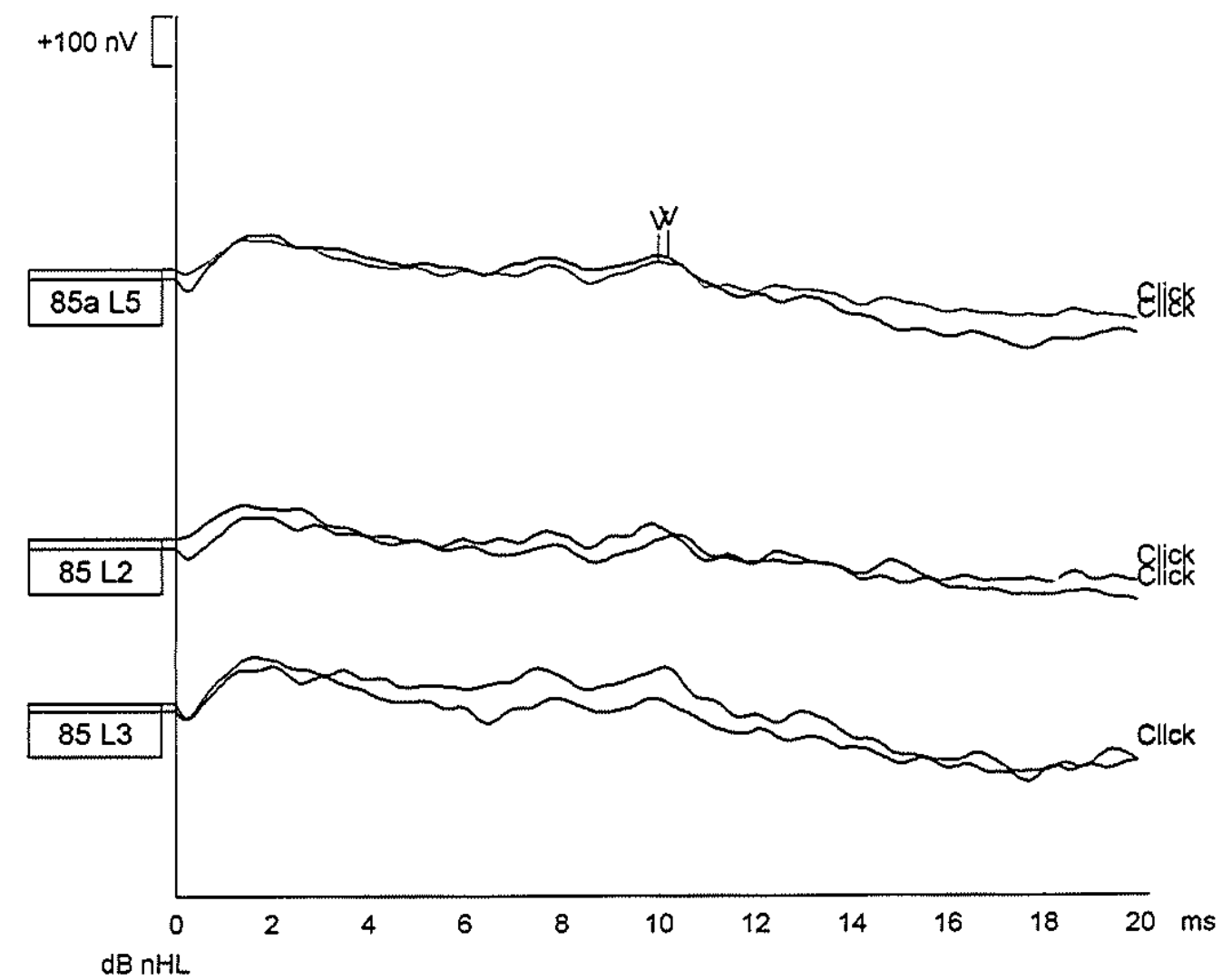
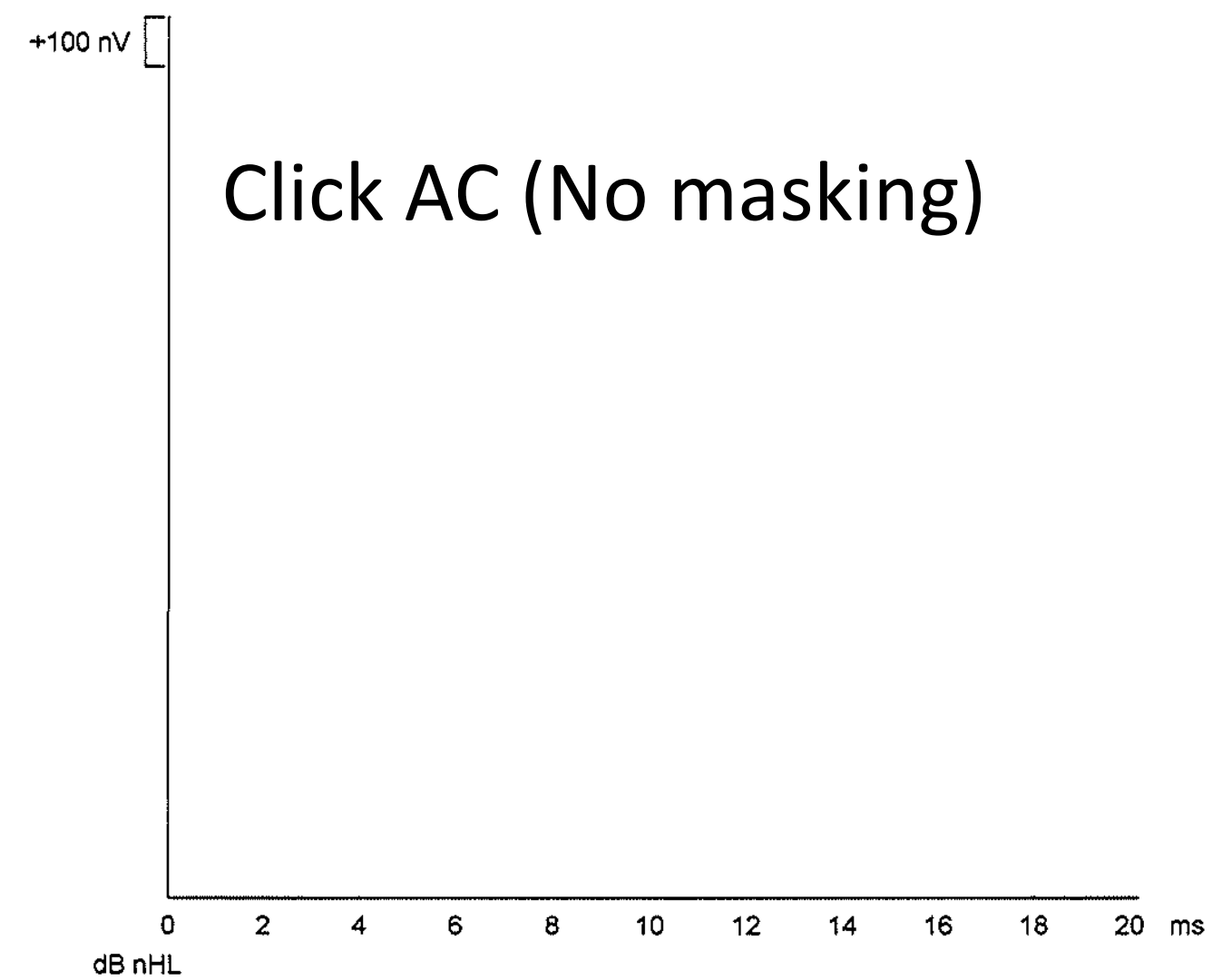


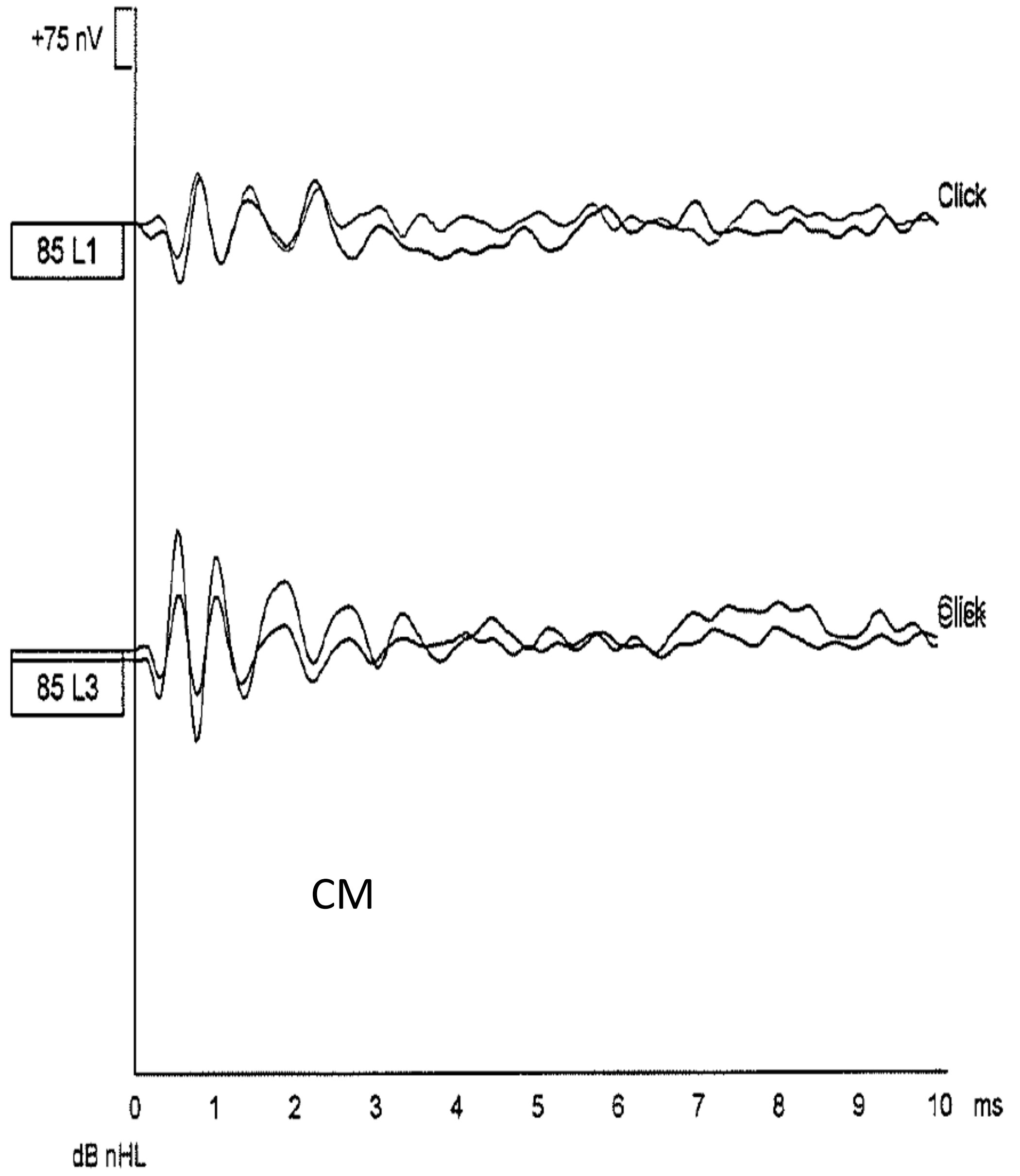


Curve	Recorded Rejected	Reject. lvl. (µV)	Masking	Wave Repro	Stimuli/ sec	Display		Ratio Resp. Ampl. RN	Polarity	Window	Freq.	Sine waves	Rise/Fall	Plateau
						Low Pass	High Pass							
40b L Ver 4.5.1.4 HPF:33 Hz 6/oct LPF:1500 Hz Bone Bayesian	4000 26%	[±80] ±9.8	80 dB SPL	97 %	49.1	1.5kHz	None	— — 33nV	NB CE-Chirp® LS Alt.	N/A	4000 Hz	N/A	N/A	N/A
40b L1 Ver 4.5.1.4 HPF:33 Hz 6/oct LPF:1500 Hz Bone Bayesian	4000 4%	[±80] ±9.8	80 dB SPL	99 %	49.1	1.5kHz	None	— — 30nV	NB CE-Chirp® LS Alt.	N/A	4000 Hz	N/A	N/A	N/A
35b L1 Ver 4.5.1.4 HPF:33 Hz 6/oct LPF:1500 Hz Bone Bayesian	4000 7%	[±80] ±9.8	75 dB SPL	99 %	49.1	1.5kHz	None	— — 19nV	NB CE-Chirp® LS Alt.	N/A	4000 Hz	N/A	N/A	N/A
35ba L3 Ver 4.5.1.4 HPF:33 Hz 6/oct LPF:1500 Hz Bone	6900 9%	[±80] ±9.8	75 dB SPL	99 %	49.1	1.5kHz	None	— — 13nV	NB CE-Chirp® LS Alt.	N/A	4000 Hz	N/A	N/A	N/A



Curve	Recorded Rejected	Reject. lvl.( $\mu$ V)	Masking	Wave Repro	Stimuli/ sec	Display		Ratio Resp. Ampl. RN	Polarity	Window	Freq.	Sine waves	Rise/Fall	Plateau
						Low Pass	High Pass							
85 L Ver 4.5.1.4 HPF:33 Hz 6/oct LPF:1500 Hz Insert phone Bayesian	4000 17%	[ $\pm$ 40] $\pm$ 5.0	---	67 %	49.1	1.5kHz	None	---	Alter.	N/A	N/A	N/A	N/A	N/A
85 L1 Ver 4.5.1.4 HPF:33 Hz 6/oct LPF:1500 Hz Insert phone Bayesian	4000 18%	[ $\pm$ 40] $\pm$ 5.0	---	84 %	49.1	1.5kHz	None	---	Alter.	N/A	N/A	N/A	N/A	N/A
85 L2 Ver 4.5.1.4 HPF:33 Hz 6/oct LPF:1500 Hz Insert phone Bayesian	4000 25%	[ $\pm$ 40] $\pm$ 5.0	---	66 %	49.1	1.5kHz	None	---	Alter.	N/A	N/A	N/A	N/A	N/A
85 L3 Ver 4.5.1.4 HPF:33 Hz 6/oct LPF:1500 Hz Insert phone Bayesian	4000 17%	[ $\pm$ 40] $\pm$ 5.0	---	89 %	49.1	1.5kHz	None	---	Alter.	N/A	N/A	N/A	N/A	N/A
85a L4 Ver 4.5.1.4 HPF:33 Hz 6/oct LPF:1500 Hz Insert phone Bayesian	8000 21%	[ $\pm$ 40] $\pm$ 5.0	---	79 %	49.1	1.5kHz	None	---	Alter.	N/A	N/A	N/A	N/A	N/A
Comments: not masked														
85a L5 Ver 4.5.1.4 HPF:33 Hz 6/oct LPF:1500 Hz Insert phone Bayesian	8000 17%	[ $\pm$ 40] $\pm$ 5.0	---	91 %	49.1	1.5kHz	None	---	Alter.	N/A	N/A	N/A	N/A	N/A
Comments: not masked														





## Case 8

- Born 26 weeks gestation
- Very small, some breathing issues and ?? Sepsis in the early days
- Initial Screen at 39 weeks GA -

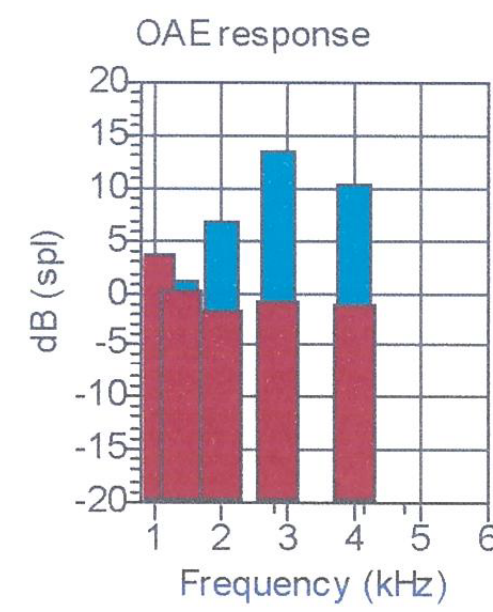
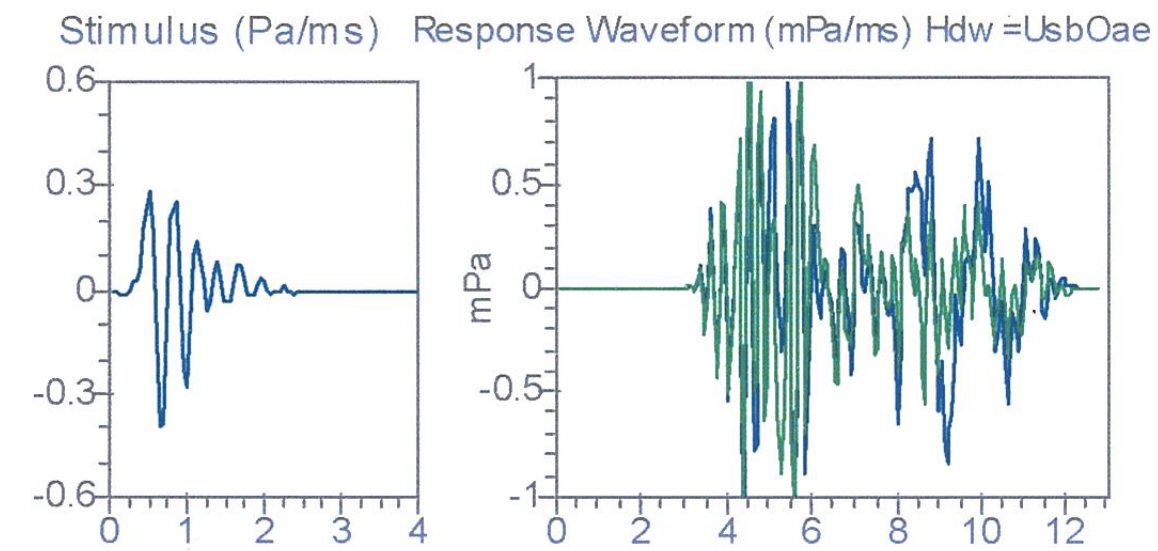
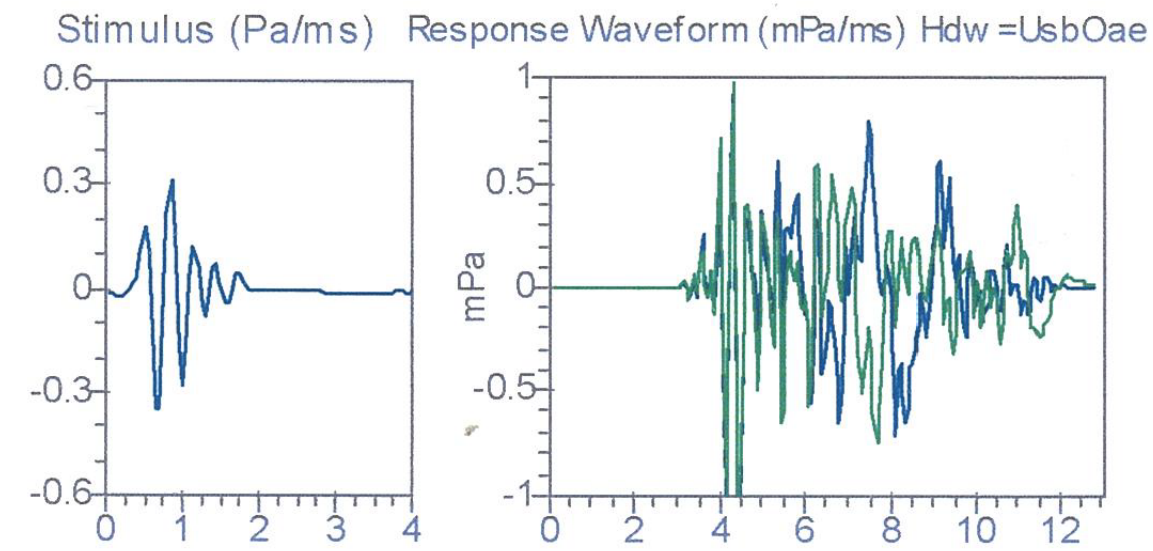
Right -	CR OAE	NCR	AABR
Left -	CR OAE	NCR	AABR

First thoughts?

**Left ear**

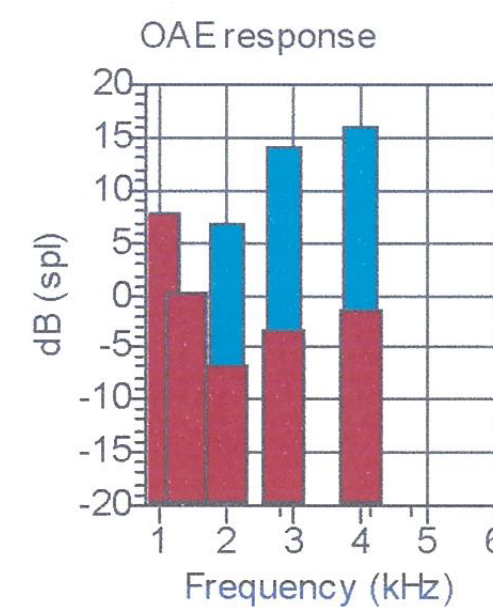
NOTES.

**Right ear**



Freq	SNR	Sig/Noise
1.0kHz	-14.3dB	-10.6/3.7dB
1.4kHz	0.7dB	1.0/0.3dB
2.0kHz	8.4dB	6.8/-1.6dB
2.8kHz	14.2dB	13.4/-0.8dB
4.0kHz	11.4dB	10.2/-1.2dB

NLo=40 NHi=65 Stim=84.0dB



Freq	SNR	Sig/Noise
1.0kHz	-18.1dB	-10.3/7.7dB
1.4kHz	-2.3dB	-2.0/0.3dB
2.0kHz	13.7dB	6.9/-6.8dB
2.8kHz	17.5dB	14.1/-3.4dB
4.0kHz	17.4dB	15.9/-1.5dB

NLo=40 NHi=147 Stim=84.2dB

Test type:	TE
Ear:	Left
Tester ID:	2
Date/Time of test:	17/08/2018 09:09:35
Data file name:	DF8S8H30.DTA

**Result** OAE detected  
**Decision** Pass

No. of tests = 1

Date	Time	1kHz	2kHz	4kHz			
1 17/08/2018	09:09:35	TE	✗	✗	✓	✓	✓

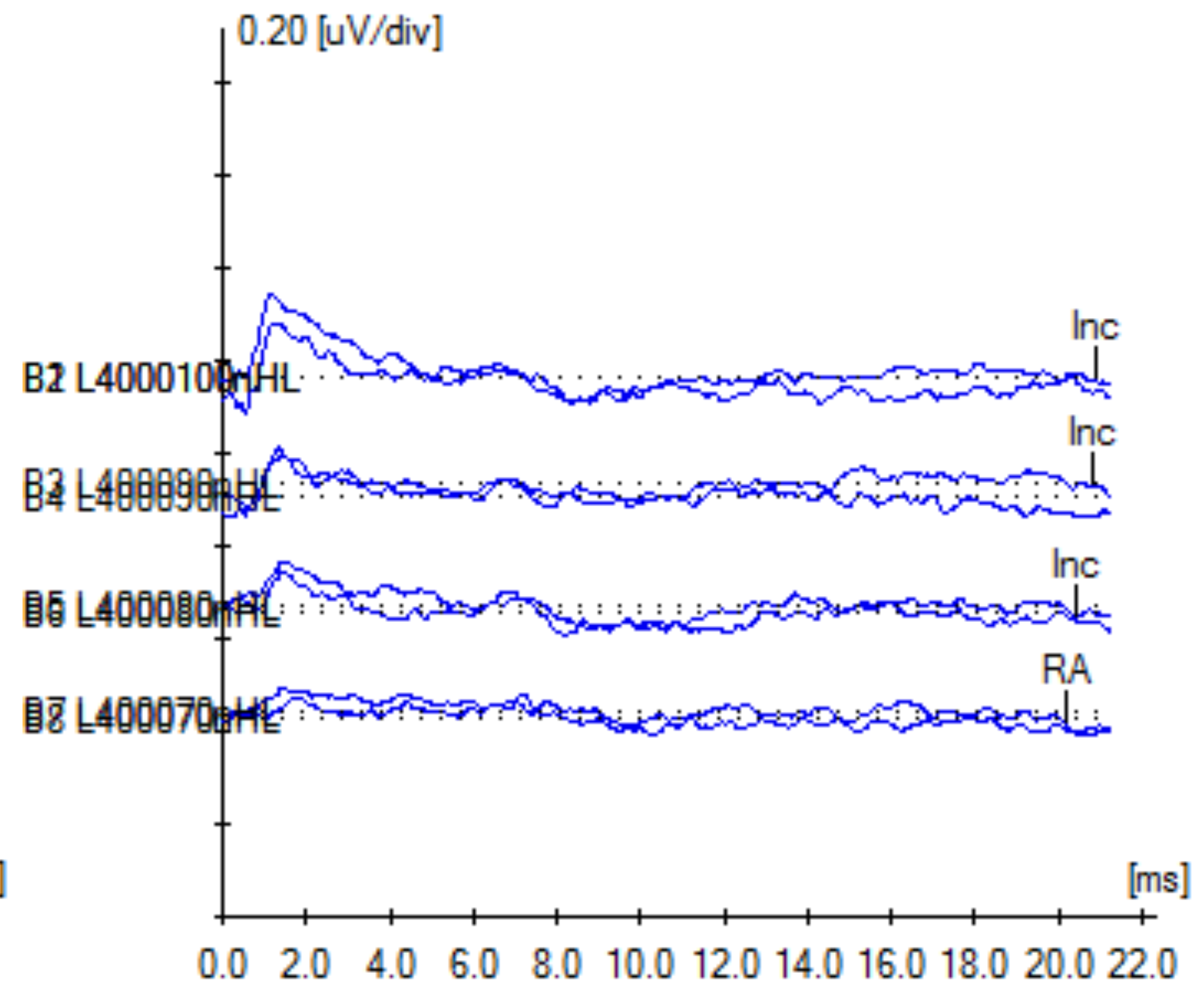
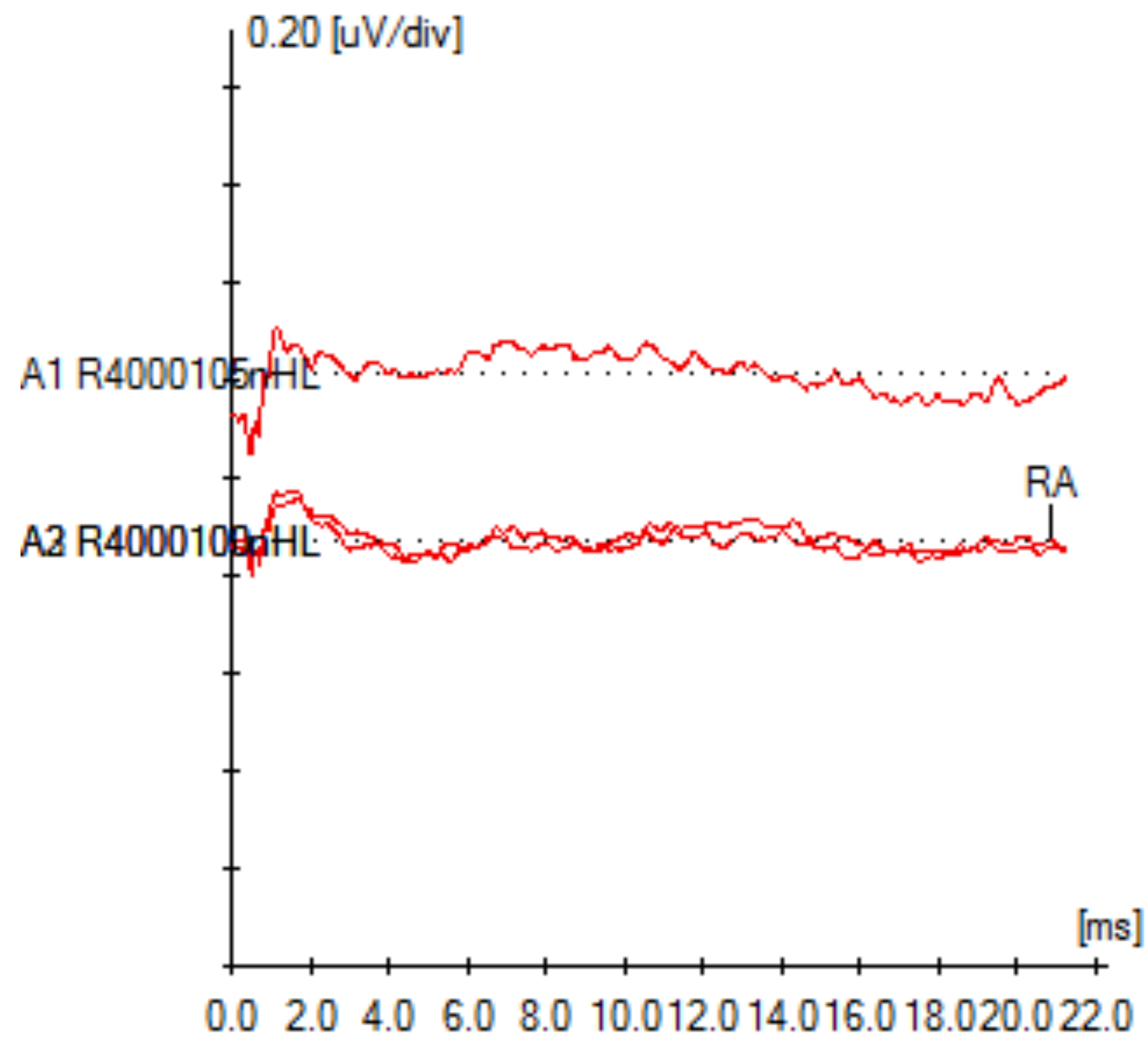
Test type:	TE
Ear:	Right
Tester ID:	2
Date/Time of test:	17/08/2018 09:46:45
Data file name:	DF8S8H31.DTA

**Result** OAE detected  
**Decision** Pass

No. of tests = 1

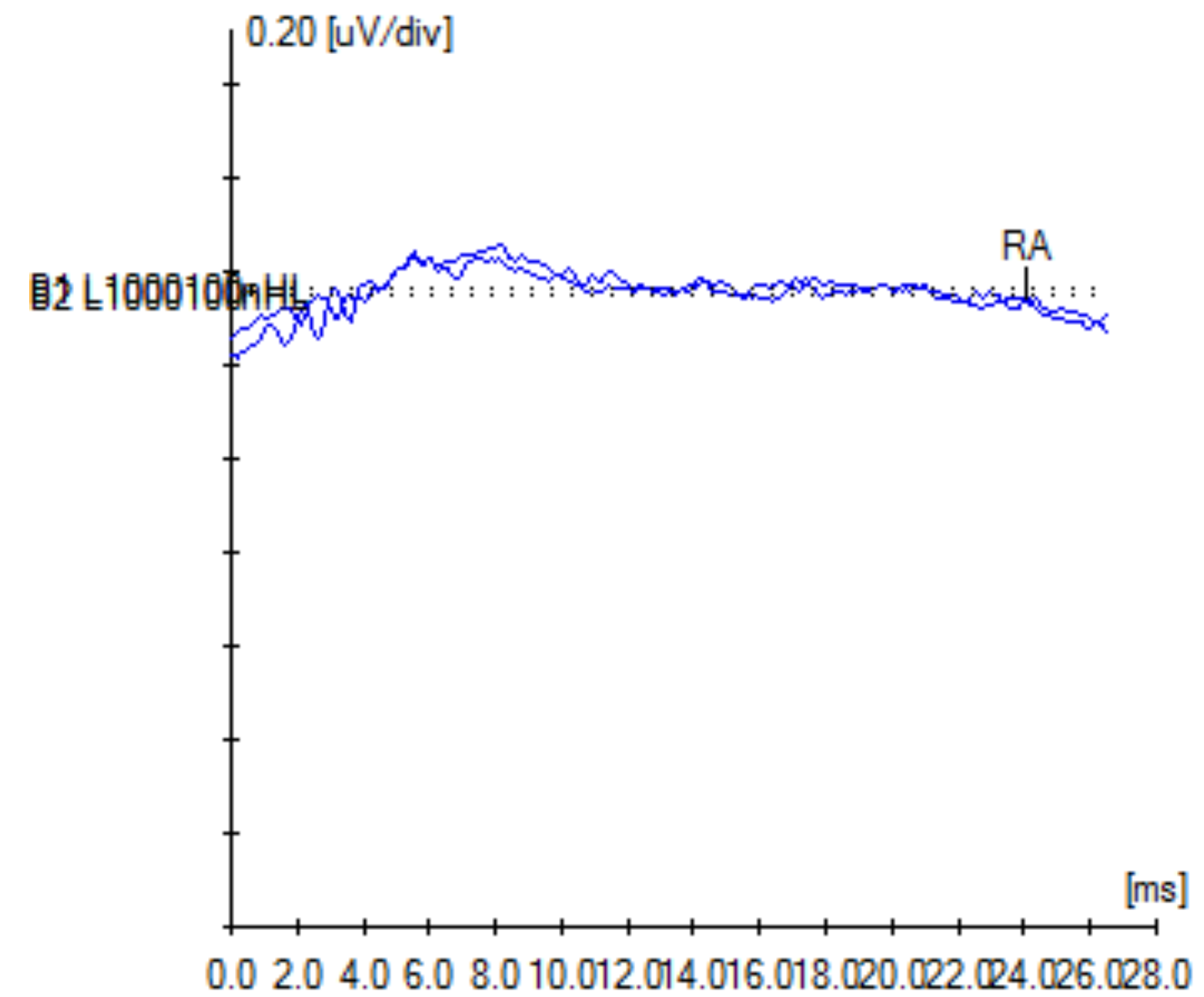
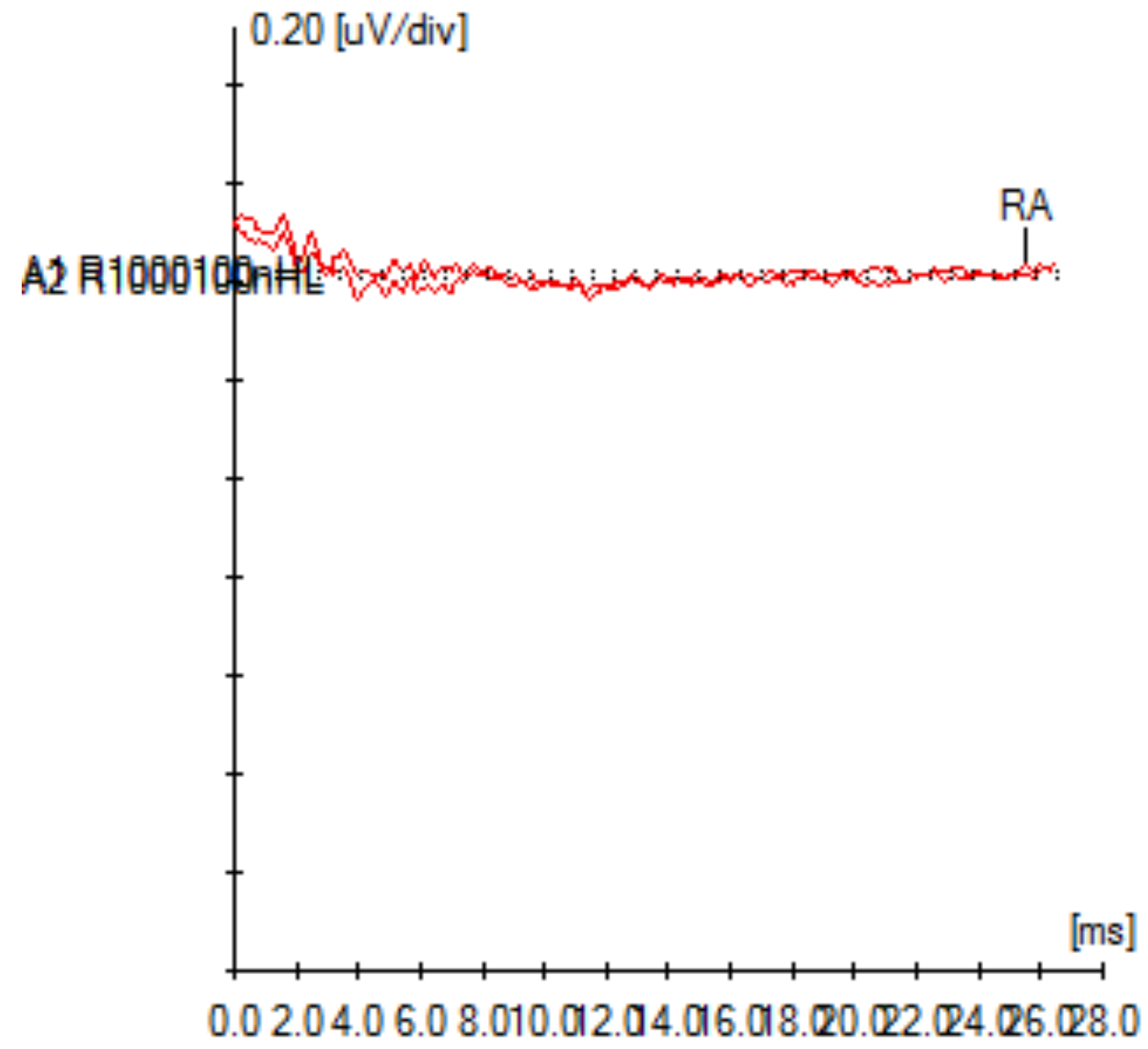
Date	Time	1kHz	2kHz	4kHz			
1 17/08/2018	09:46:45	TE	✗	✗	✓	✓	✓

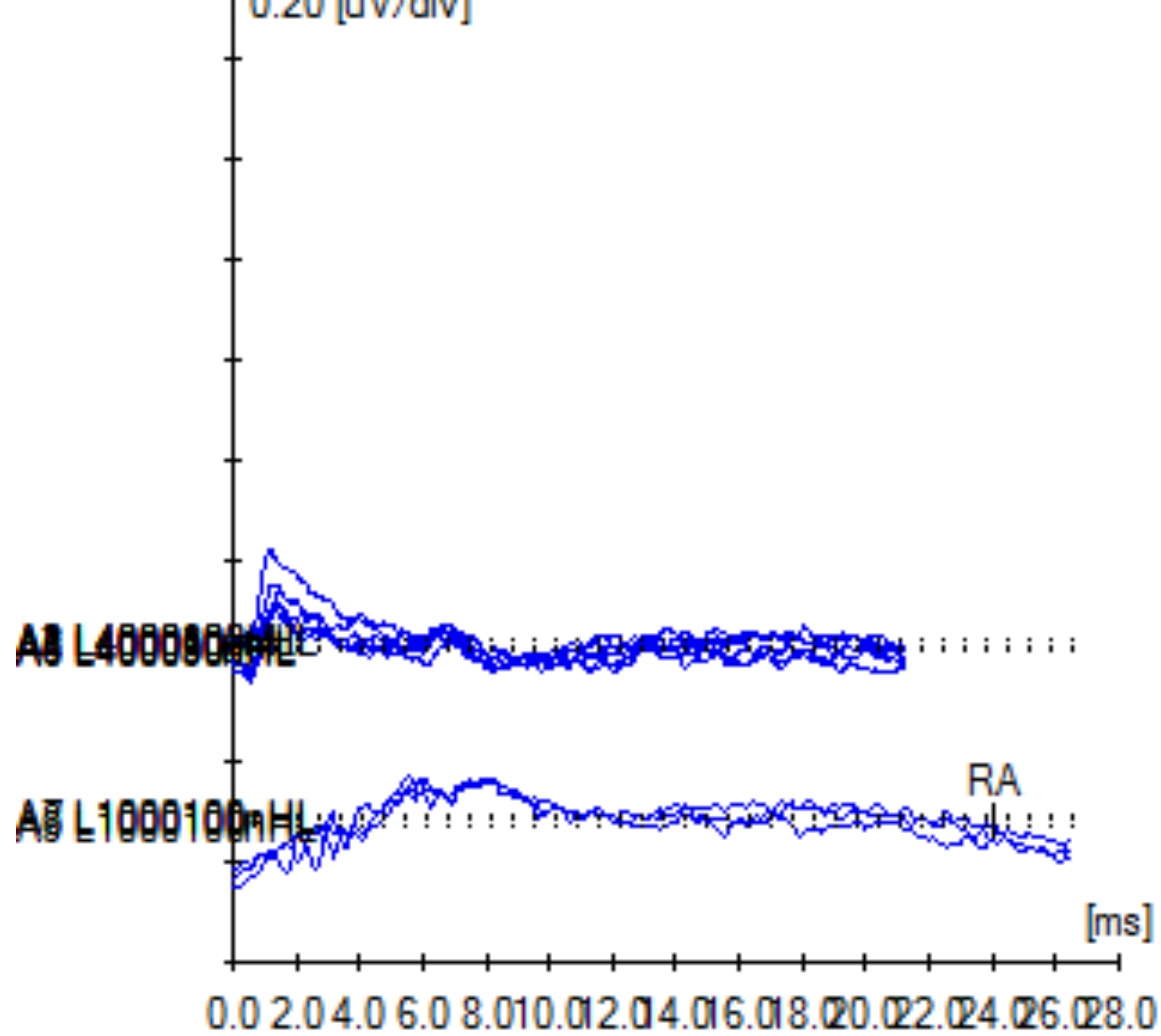
# 4k AC HP TP



# ABR performed under natural sleep (8 weeks corrected age)

1k AC HP TP





What do we think?

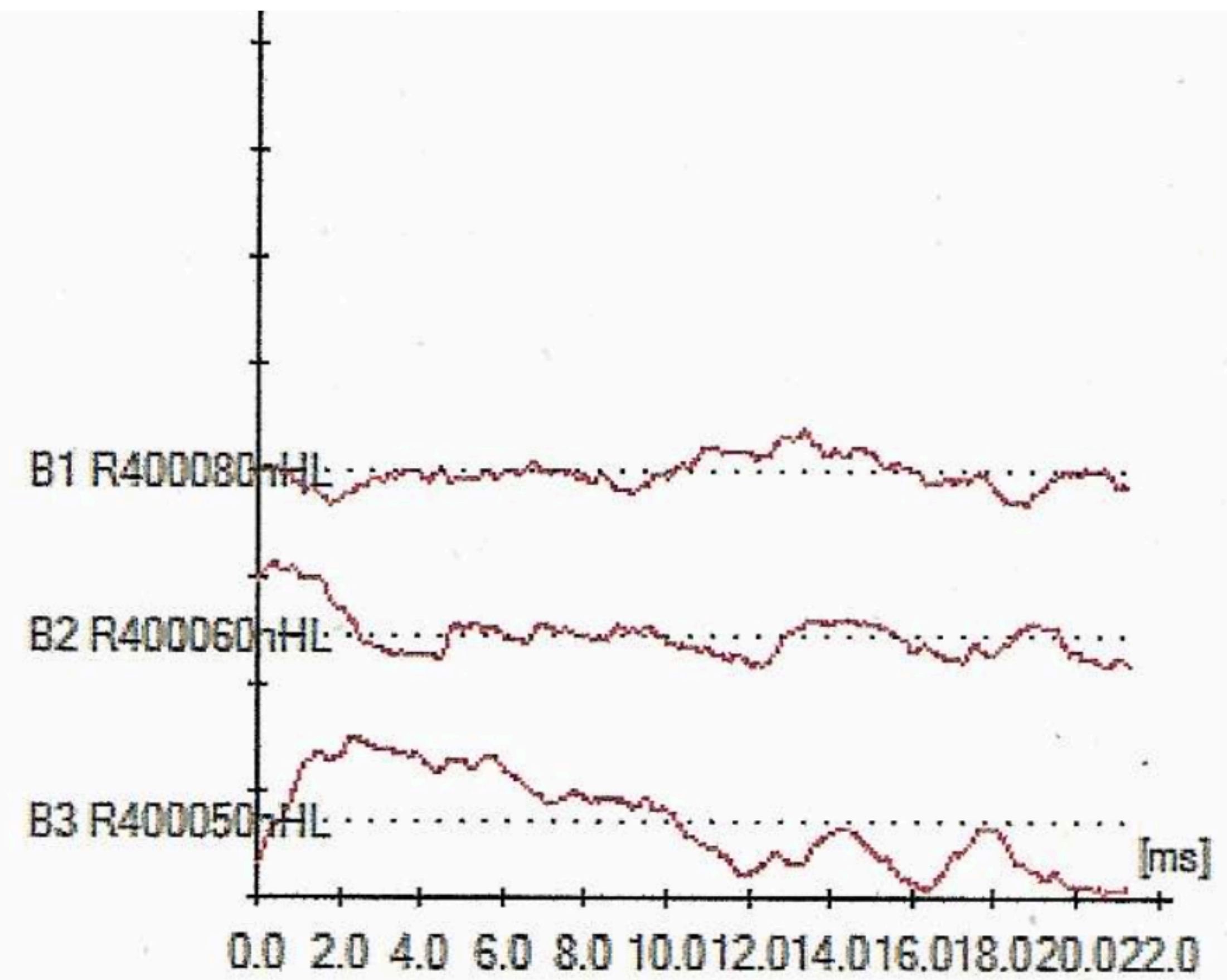
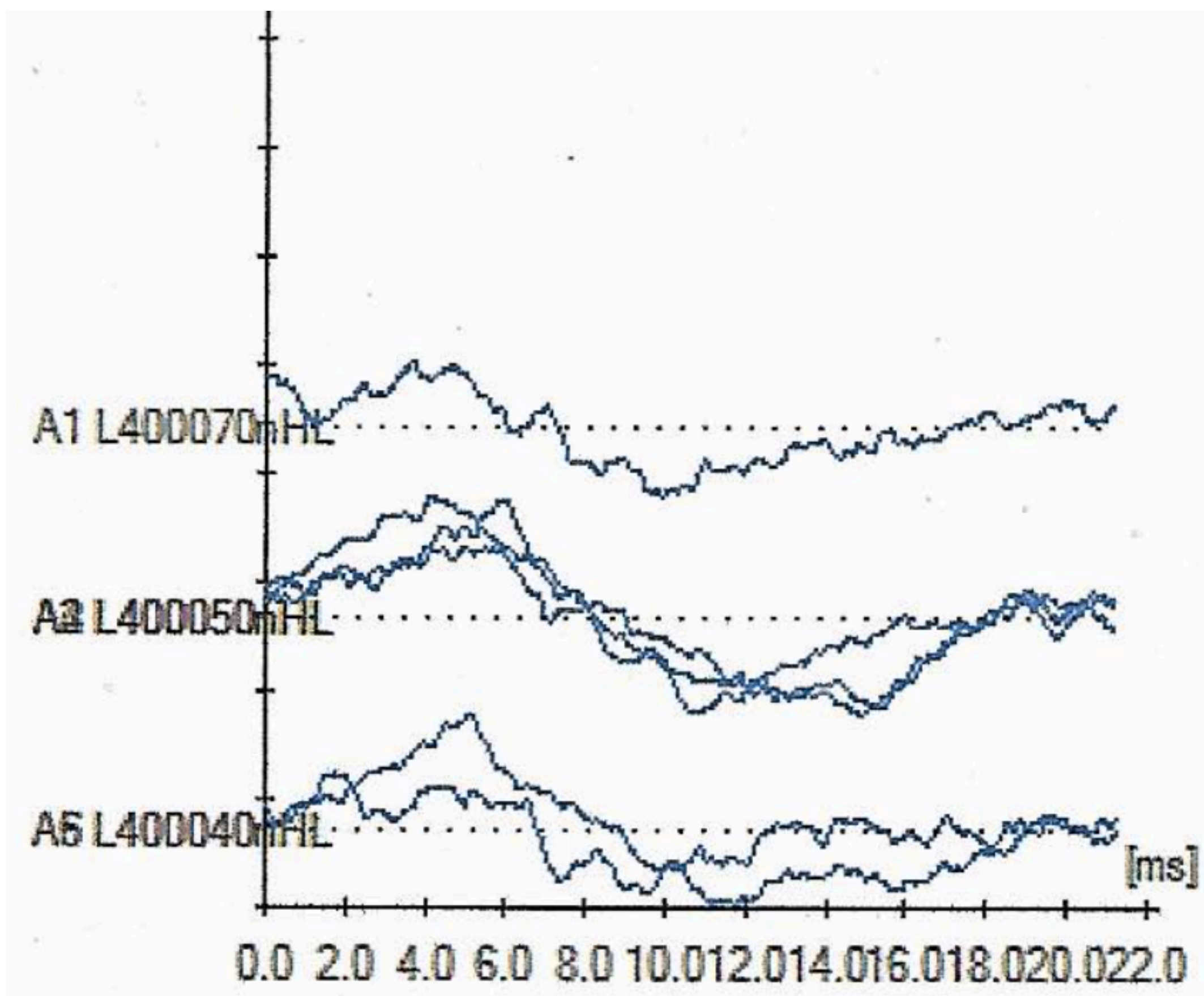


## Case 9

Please could you see this 26 week old who has been extremely unwell since birth - they have not been seen for screening

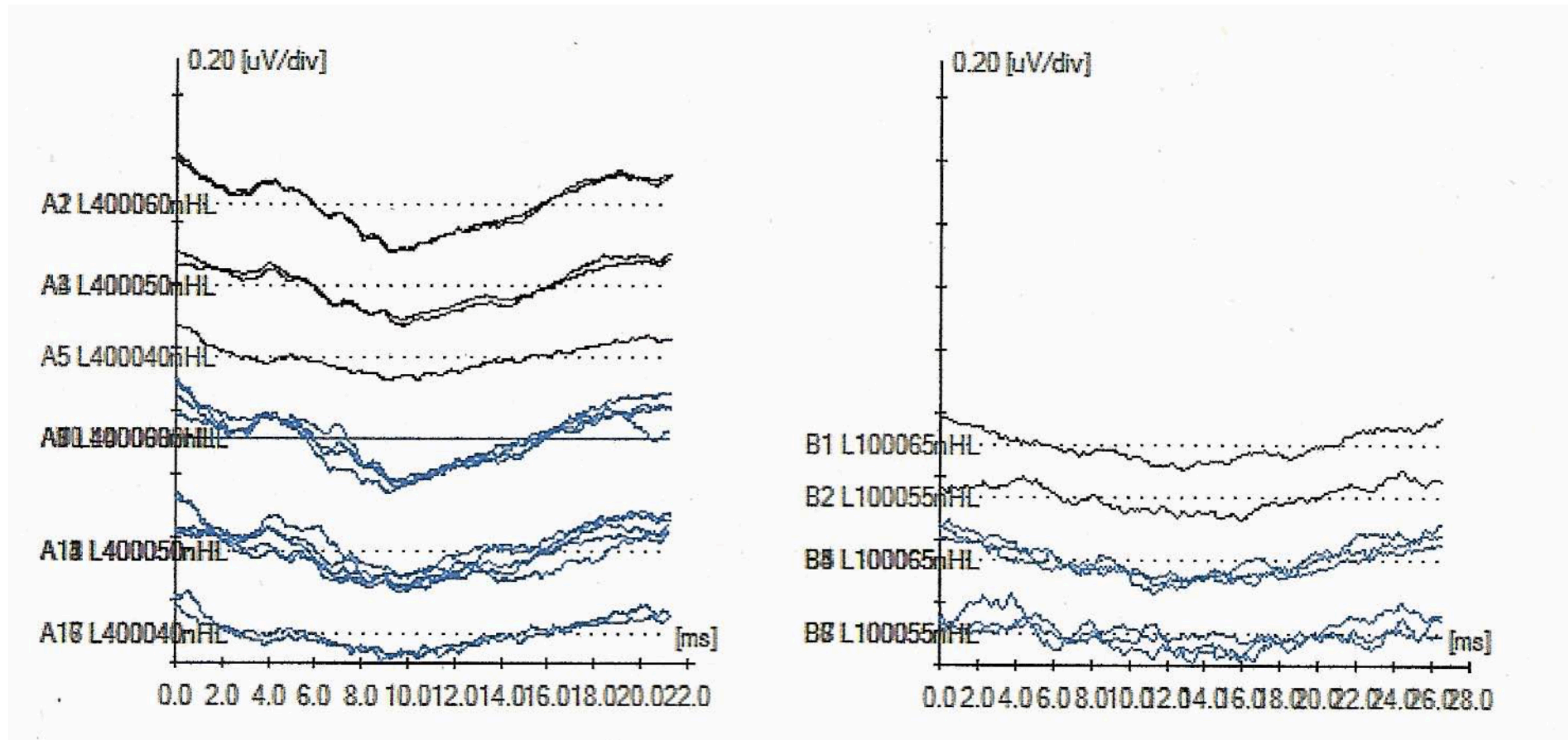
No syndrome has yet been fully identified through genetics, however he has a 'cobble appearance brainstem' on MRI consistent with Walker-Warberg syndrome. He is not regulating his own body temperature however has recently come off ventilation. The head MRI notes that there is a common IAM cavity on the right, with no cochlear or SCC and no apparent auditory, vestibular, facial or visual nerves. The left appears normal. They are able now to come down to your department and sleep most of the day

First thoughts?



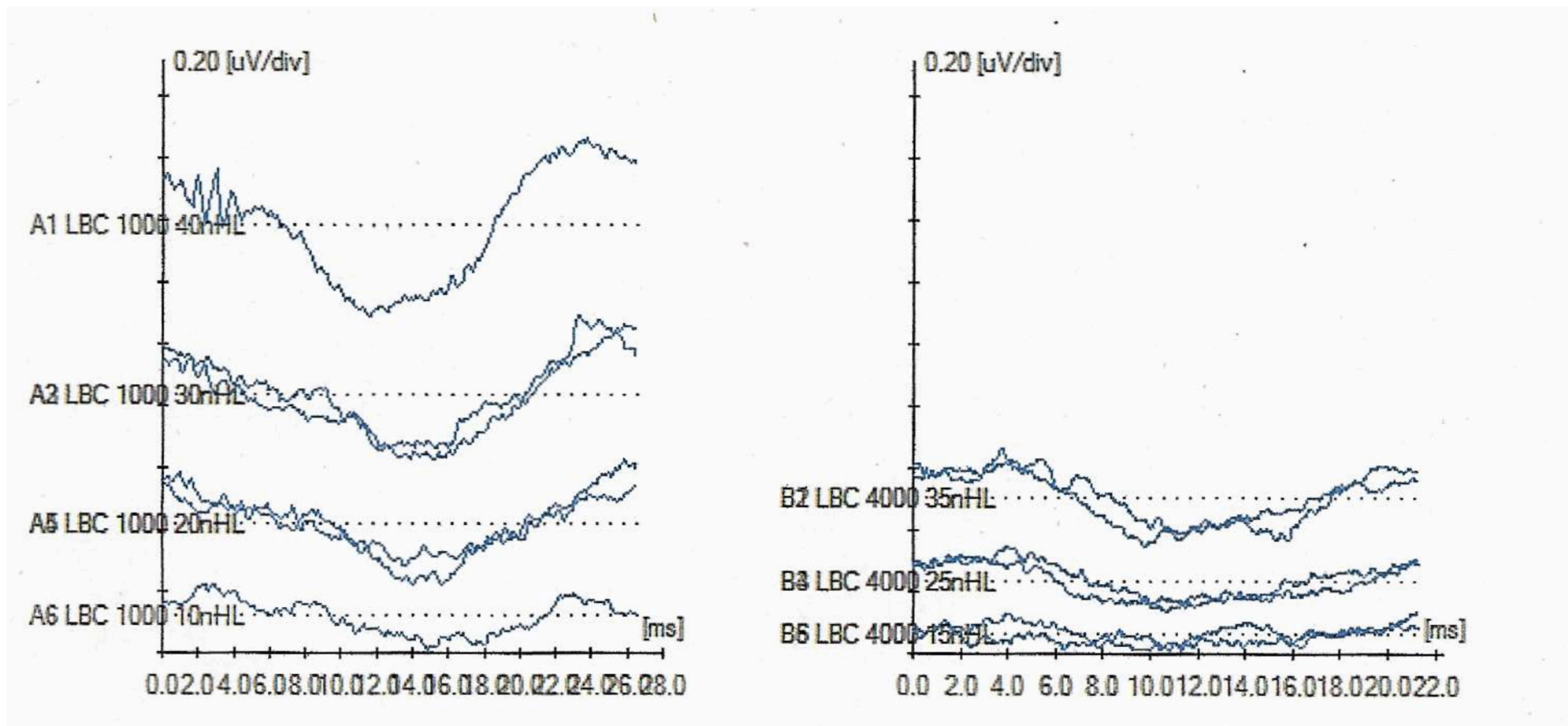
EEG very noisy even though child appears settled - 4kHz AC HP (-10 correction)

Thoughts? Next?



Ok, lets go off piste - slow the rate down to see if we get a better response

4kHz -10, 1kHz -15 Thoughts? Next?



1kHz BC and 4kHz BC (at this age, both -10 correction)

What we telling parents? Management?