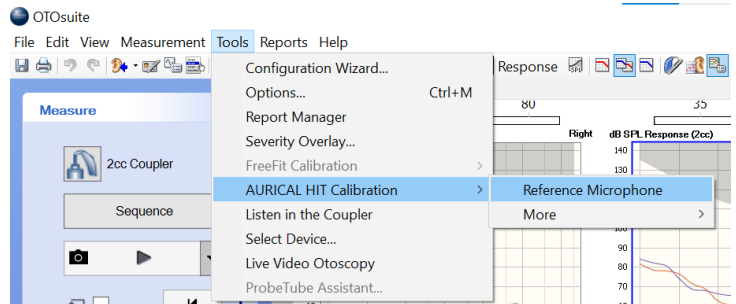


Testing Advanced Bionics (AB) processors in the Aurical Hearing Instrument Test (HIT) Box

You will need the [AB Naída CI Listening Check](#) or the [AB Naída CI Marvel Listening Check](#) and a [Connevans DCTEST4 lead](#).

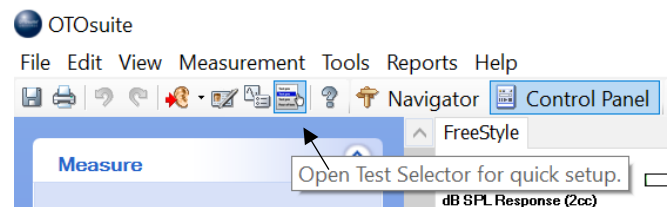
Step 1 – Connect the Aurical HIT, start Otosuite and calibrate.

You will record processor curves to compare with the RM responses.



Step 2 – Select the appropriate test from the Test Selector icon.

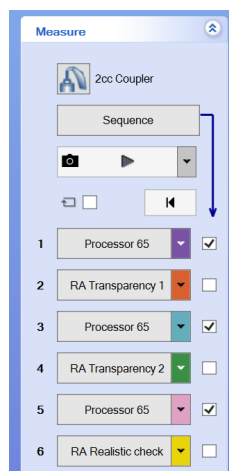
Select **RM Transparency and Reality 65dB**.



Step 3 – Connect the correct listening check to the processor.

Step 4 – Signal and Sequence

There is no first-stage compression in AB processors, so a 65 dB signal is appropriate.



Position the AB processor and the reference microphone appropriately in the Aurical (Figure 2). Close the lid, checking that the reference microphone does not move position.

Tick the boxes for curves 1, 3 and 5.
Click on **Sequence**.

This will create three overlapping processor curves.

Figure 2.



Judicious use of acoustic putty will help you position the processor mid-line with the speaker and the reference microphone within 1–2 mm of the active microphone (T-mic or processor microphone).

Now attach the Roger 17 to the Naída CI, or check that a Roger licence is installed in the Naída CI M or Sky CI M.

Put the Roger transmitter into verification mode and then connect to the receiver.

Make a note of the receiver’s current EasyGain setting, and then reset the receiver to the *default* setting (even if already on EasyGain 0).

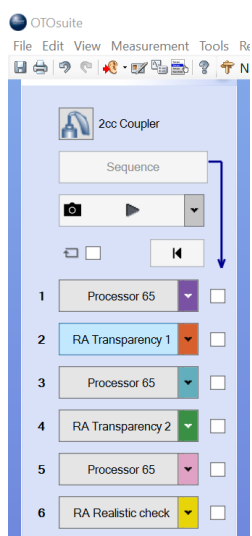
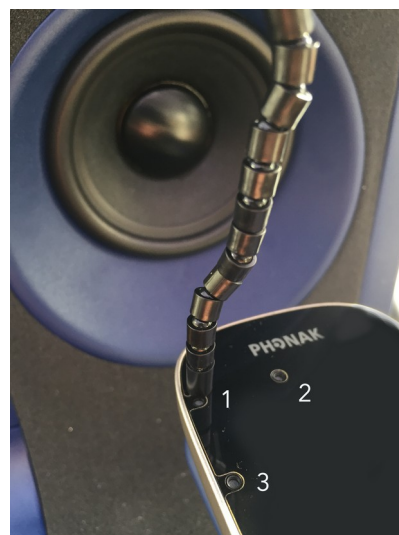
Place the processor with its receiver to one side (preferably in a muffled box).

Now place the Roger transmitter in the Aurical with the reference microphone within 1–2 mm of the active transmitter microphone. In verification mode position 1 is active.

Step 4 – Remote Microphone (RM) signals

Carefully close the Aurical’s lid, and reopen briefly to check the reference microphone has not moved; adjust if needed.

Now run a RM curve on the default setting.



Run curve 2. Click on **RM Transparency 1** and note the response. If you need to adjust the EasyGain, do so.

Run curve 4. Click on **RM Transparency 2** until transparency is reached (by repeating and overwriting curve 4).

Now run a ‘reality check’ with a more realistic signal level, like a teacher’s voice. Compression in the whole system means you are likely to see a difference between the processor and RM signals of 6 dB or more (Figure 3 below), but well less than the Roger’s maximum gain of 20 dB.

Figure 3. Naida CI curves

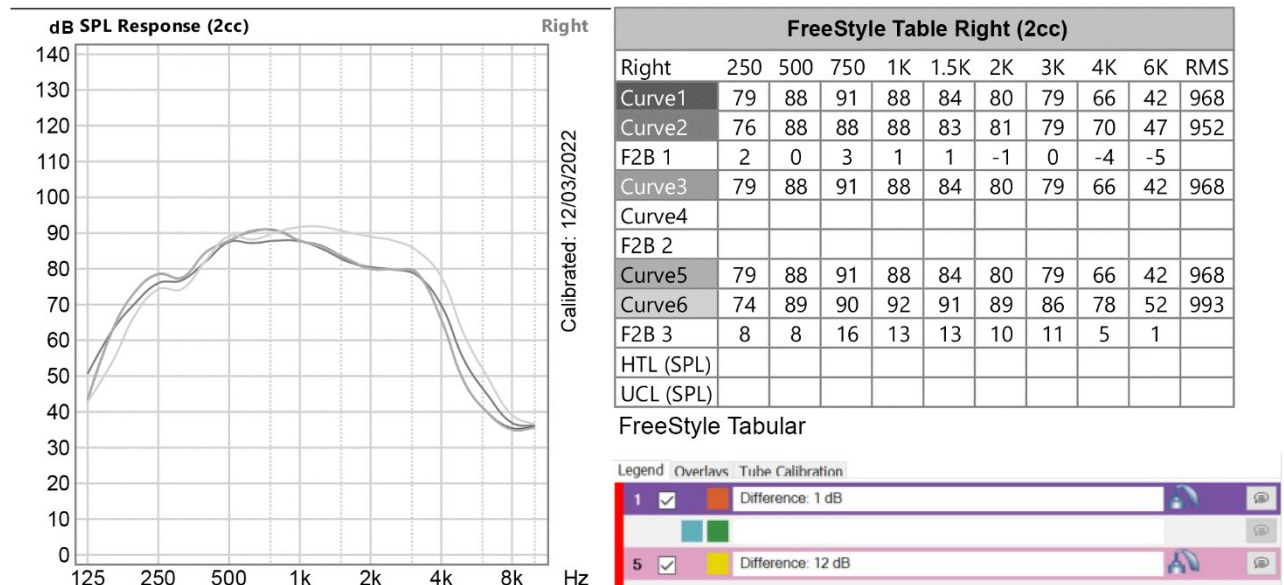
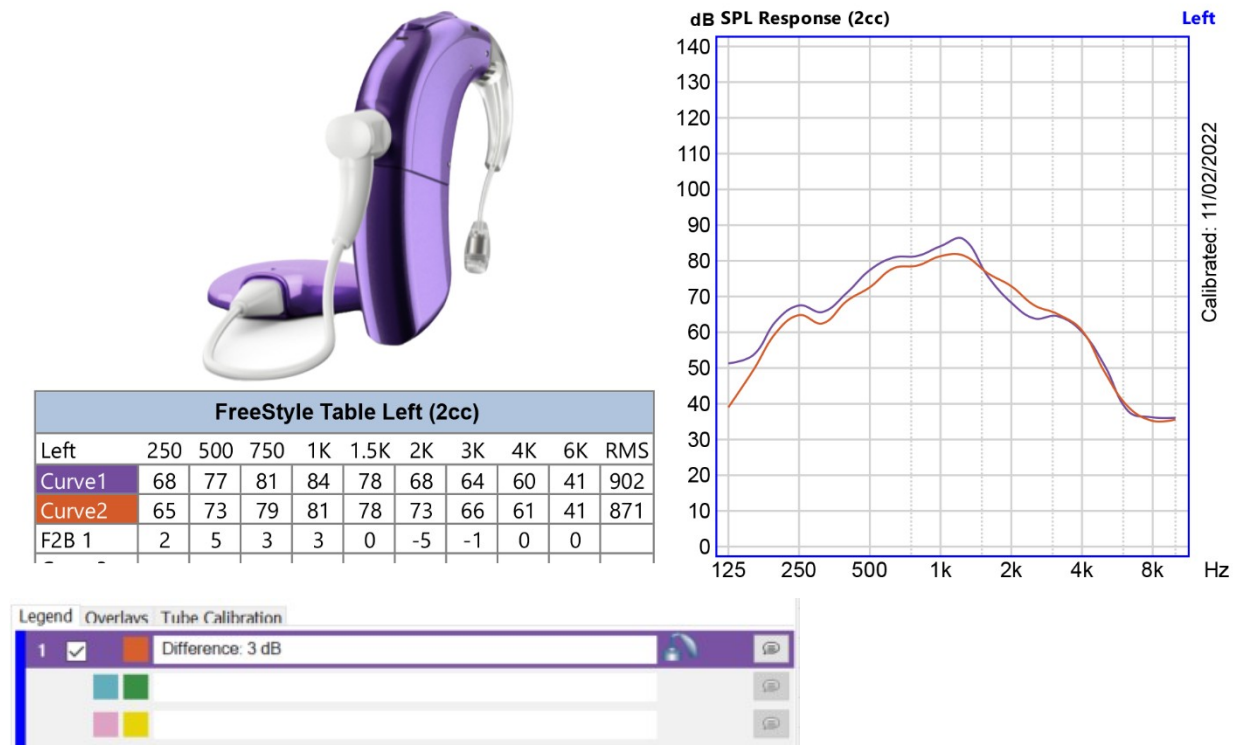


Figure 4. Naida CI Marvel curves



How do you know when you have achieved transparency?

- By eye and the gain difference table (Figures 3 and 4).
- Using the standard offset protocol
- Using the new RMS protocol for hearing instruments in line with BS EN IEC 60118-16.

1. **By eye** – The processor and the RM responses should overlap, and the gain difference table should show suitable values for each pair of curves (CI) and (CI + RM).

2. **Standard protocol** – compare the mid-frequency average for processor and RM.

Frequency (Hz)	750	1000	2000	Average	Difference
CI dB (SPL)	a	b	c	$A_1 = (a+b+c)/3$	
CI & RM dB (SPL)	x	y	z	$A_2 = (x+y+z)/3$	$A_2 - A_1$

3. Revised offset protocol – calculate the broad average 750 Hz – 4 kHz for processor and RM and compare.

4. New RMS protocol – calculate the broad average for processor and RM and compare.

Compute the root mean square of the difference in one-third octave levels from 800 Hz to 5 kHz of the output signal of the processor with the output signal of processor and RM. If the difference is 2 dB larger than the measurement tolerance*, then two output signals are different.

Frequency (Hz)	800	1000	1250	1600	2000	2500	3150	4000	5000	RMS	Difference
CI dB (SPL)	a	b	c	d	e	f	g	h	i	R_1	
CI & RM dB (SPL)	r	s	t	u	v	w	x	y	z	R_2	$R_2 - R_1$

$$R_1 = \sqrt{((a^2+b^2+c^2+d^2 + e^2 + f^2 + g^2 + h^2 + i^2)/9)}$$

$$R_2 = \sqrt{((r^2+s^2+t^2 + u^2 + v^2 + w^2 + x^2 + y^2 + z^2)/9)}$$

* For the Aurical, the measurement tolerance is 1 dB, so transparency is achieved if the processor and RM responses are within 3 dB of each other (± 3 dB).

1. By eye – Aurical

Naida CI report: Curves 1 & 2: Difference 0 dB; Curves 5 & 6: Difference 12 dB

Naida CI M report: Curves 1 & 2: Difference 3 dB

2. Standard protocol – compare the mid-frequency average for processor and RM.

Naida CI Q

	Frequency (Hz)	750	1000	2000	Average	Difference
[1]	CI dB (SPL)	91	88	80	86.3	
[2]	CI & RM dB (SPL)	88	88	81	85.7	-0.7

	Frequency (Hz)	750	1000	2000	Average	Difference
[5]	CI dB (SPL)	91	88	80	86.3	
[6]	CI & RM dB (SPL)	90	92	89	90.3	4.0

The Reality check values seems a bit low because the values at 1 kHz or less are similar, but the difference at 2 kHz is 9 dB. See the table and shape of the curve in Fig. 3.

Naida CI M

	frequency - (Hz)	750	1000	2000	Average	Difference
[1]	CI dB (SPL)	81	84	68	77.7	
[2]	CI & RM dB (SPL)	79	81	73	77.7	0.0

4. Revised offset protocol – calculate the broad average 750 Hz – 4 kHz for processor and RM and compare.

Naida CI Q	750 Hz	1 kHz	1.5 kHz	2 kHz	3 kHz	4 kHz	Average	Difference
1	91	88	84	80	79	66	81.3	
2	88	88	83	81	79	70	81.5	0.2

Naida CI Q	750 Hz	1 kHz	1.5 kHz	2 kHz	3 kHz	4 kHz	Average	Difference
5	91	88	84	80	79	66	81.3	
6	90	92	91	89	86	78	87.7	6.3

Naida CI M	750 Hz	1 kHz	1.5 kHz	2 kHz	3 kHz	4 kHz	Average	Difference
1	81	84	78	68	64	60	72.5	
2	79	81	78	73	66	61	73.0	0.5

4. New RMS protocol – calculate the broad average for processor and RM and compare.

Compute the root mean square of the difference in one-third octave levels from 800 Hz to 5 kHz of the output signal of the processor with the output signal of processor and RM. If the difference is 2 dB larger than the measurement tolerance*, then two output signals are different.

Naida CI Q

	Frequency (Hz)	800	1000	1250	1600	2000	2500	3150	4000	5000	RMS	Difference
[1]	CI dB (SPL)	90.7	87.9	86.3	82.5	80.0	79.8	78.9	65.7	48.4	78.8	
[2]	CI & RM dB (SPL)	87.9	87.7	85.5	82.0	80.5	79.8	78.2	69.8	54.5	79.1	0.3

	Frequency (Hz)	800	1000	1250	1600	2000	2500	3150	4000	5000	RMS	Difference
[5]	CI dB (SPL)	90.5	87.8	86.2	82.6	80.1	79.8	78.6	65.8	48.5	78.7	
[6]	CI & RM dB (SPL)	90.3	91.7	91.7	90.2	89.0	87.9	85.1	77.7	61.6	85.8	6.8

Naida CI M

	Frequency (Hz)	800	1000	1250	1600	2000	2500	3150	4000	5000	RMS	Difference
[1]	CI dB (SPL)	78.7	81.3	81.5	76.4	72.9	67.6	65.1	60.5	48.8	71.1	
[2]	CI & RM dB (SPL)	81.4	84.1	86.1	75.4	68.3	63.9	64.5	60.1	50.6	71.4	0.3