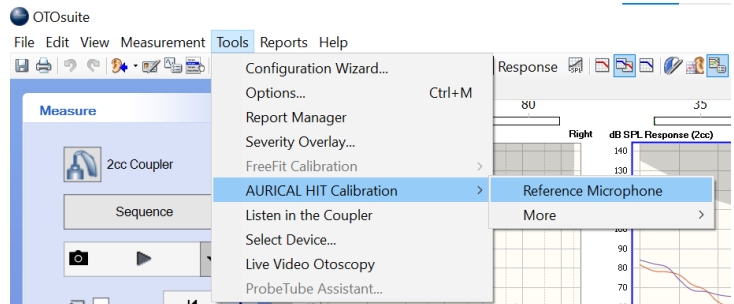


## Testing SONNET processors in the Aurical Hearing Instrument Test (HIT) Box

You will need the [MED-EL Microphone Test Device \(MTD\) and MTD adapter](#) and a [Connevens DCTEST4 lead](#).

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

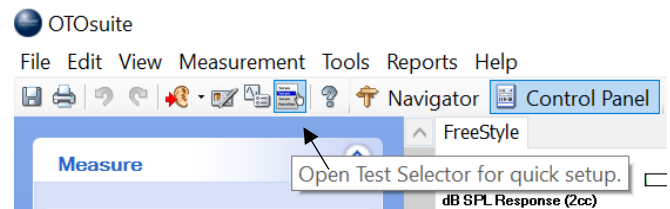
You will record processor curves to compare with the radio aid responses.



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

There is first-stage compression in MED-EL processors, so a 55dB signal is suitable, but quiet conditions are required. *If this is not possible, use a 65 dB signal.*

Select RM Transparency and Reality 55dB.



**Step 3** Connect the MTD and adapter with the processor.

The SONNET MTD adapter enables wireless transmission of the SONNET microphone signals via the attached audio processor coil (DCoil and DL-Coil). You will need the SONNET's FineTuner or the SONNET 2's FineTuner Echo.

Turn the MTD volume up to maximum, use the self-test function to check this. Now, put the MTD coil and the SONNET coil together. Listen to the DCTEST4 lead, you will hear a 'ticking' sound (Figure 1).



Figure 1.

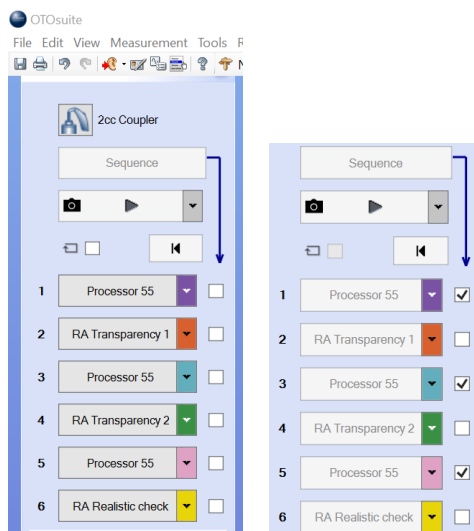
To activate the monitoring mode of the SONNET audio processor, press the M key of the FineTuner for more than 2 seconds.

To activate the monitoring mode of the SONNET 2 audio processor, press the MT key of the FineTuner Echo for more than 2 seconds.

You will now be able to hear the processor microphone (no ticking now), and be able to record response curves in the Aurical HIT.



## Step 4 – Signal and Sequence



To avoid compression in the SONNET system, a 55dB signal is presented to the processor.

### RM Transparency and Reality 55dB.

Position the SONNET 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 SONNET mid-line with the speaker and the reference microphone within 1–2 mm.

Now attach the Roger 21 or 'FM' battery cover with a Roger X receiver.

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).

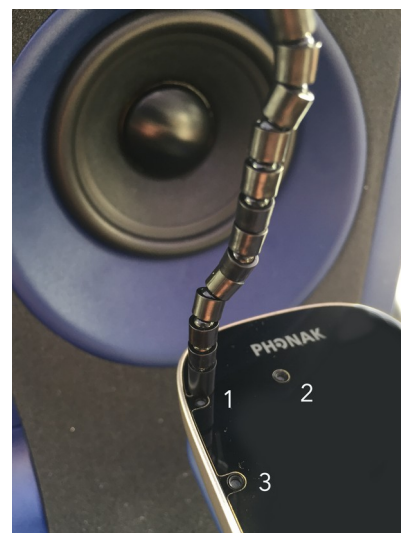
You will need to put the SONNET back into monitoring mode, so repeat step 3 and check, by listening to the DCTEST4 lead, that you can hear the Roger transmitter.

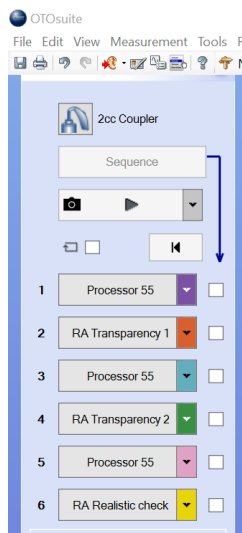
Place the processor with its receiver to one side (preferably in a muffled box).

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 – Radio Aid signals

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





Now you run a radio aid 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 system means you are likely to see a difference between the processor and radio aid signals of 6 dB or more (Figure 3 below), but well less than the Roger’s maximum gain of 20 dB.

### How do you know when you have achieved transparency?

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

**1. By eye** – The processor and the radio aid 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 radio aid.

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. New RMS protocol** – calculate the broad average for processor and radio aid 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 radio aid. 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	$R_2$	$R_2 - R_1$

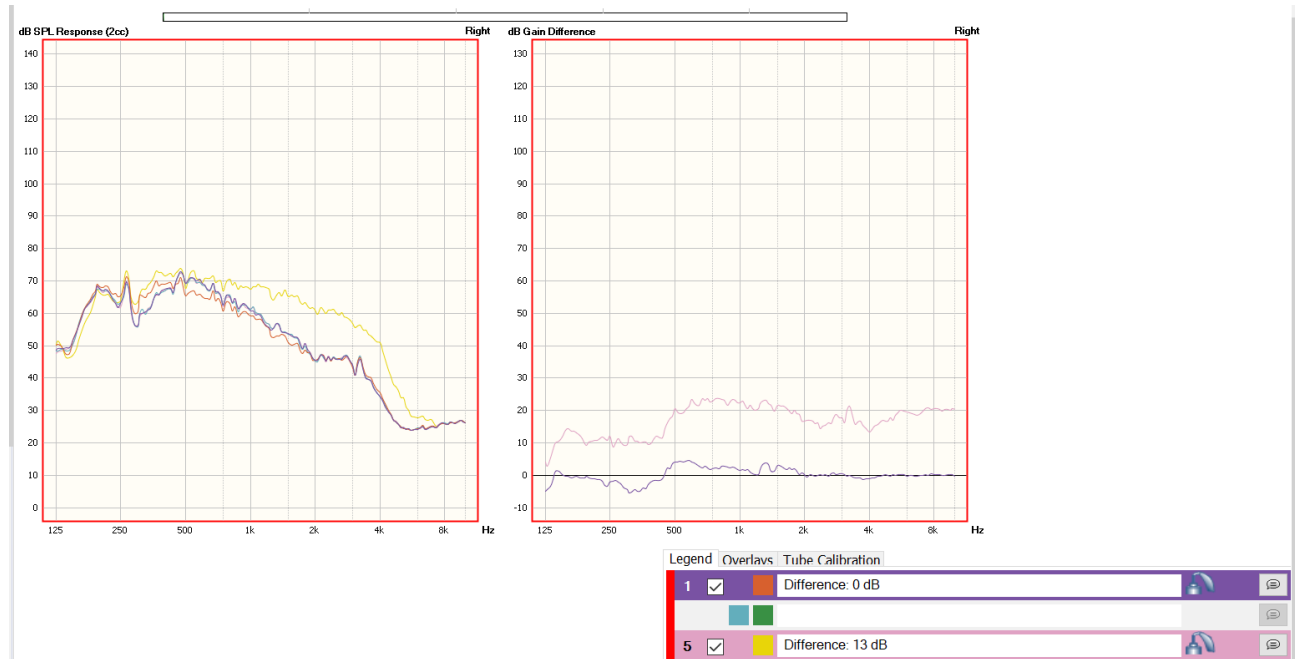
$$R_1 = \sqrt{((a^2+b^2+c^2+d^2 + e^2 + f^2 + g^2 + h^2 + i^2)/9)}$$

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

\* For the Aurical, the measurement tolerance is 1 dB, so transparency is achieved if the processor and radio aid responses are within 3 dB of each other ( $\pm 3$  dB).

The Otosuite curves are usually sampled as 3 points, but you can select 24 points as in the example below. However, this does make the curve less smooth.

Figure 3. SONNET and Roger 21 at EasyGain 0 showing electroacoustic transparency.



FreeStyle Table Right (2cc)										
Right	250	500	750	1K	1.5K	2K	3K	4K	6K	RMS
Curve1	63	69	63	61	54	46	44	34	24	850
Curve2	65	65	61	59	51	45	43	35	25	846
F2B 1	-2	4	2	1	3	0	1	-1	-1	
Curve3	63	69	63	61	54	45	44	34	25	848
Curve4										
F2B 2										
Curve5	62	69	62	61	53	46	44	34	24	848
Curve6	64	68	67	68	65	61	57	51	28	883
F2B 3	12	21	22	22	21	16	18	13	20	

**1. By eye – Aurical reports**

Curves 1 & 2: Difference 0 dB

Curves 5 & 6: Difference 13 dB

**2. Standard protocol** – compare the mid–frequency average for processor and radio aid.

	Frequency (Hz)	750	1000	2000	Average	Difference
[1]	CI dB (SPL)	63	61	46	56.7	
[2]	CI & RM dB (SPL)	61	59	46	55.3	-1.3

	Frequency (Hz)	750	1000	2000	Average	Difference
[5]	CI dB (SPL)	62	61	46	56.3	
[6]	CI & RM dB (SPL)	67	68	61	65.3	9.0

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

N7	750 Hz	1 kHz	1.5 kHz	2 kHz	3 kHz	4 kHz	Average	Difference
1	63	61	54	46	44	34	50.3	
2	61	59	51	45	43	35	49.0	-1.3

N7	750 Hz	1 kHz	1.5 kHz	2 kHz	3 kHz	4 kHz	Average	Difference
5	62	61	53	46	44	34	50.0	
6	67	68	65	61	57	51	61.5	11.5

**4. New RMS protocol** – calculate the broad average for processor and radio aid 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 radio aid. 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
[1]	CI dB (SPL)	65.0	60.7	54.7	52.7	45.5	45.8	44.1	34.2	24.7	49.0	
[2]	CI & RM dB (SPL)	63.1	59.2	53.1	50.4	45.4	45.8	45.1	35.4	25.0	48.2	-0.7

	Frequency (Hz)	800	1000	1250	1600	2000	2500	3150	4000	5000	RMS	Difference
[5]	CI dB (SPL)	65.5	61.23	55.5	52.5	45.2	46.0	45.1	34.3	25.0	49.3	
[6]	CI & RM dB (SPL)	70.4	67.5	65.0	65.1	60.9	60.3	56.1	51.0	33.9	59.8	10.5