Knowles®

TB17

TECHNICAL BULLETIN

BROADER BAND BK APPLICATION NOTES

The published response curve for the BK-1839 is achieved with the drive and acoustic coupling parameters shown on the sheet 2.1. These parameters are referred to as 'standard' in this report. They were selected after consultation with a number of hearing aid manufacturers to find typical dimensions.

The following data is intended to act as a guide-line for the hearing aid designer and fitter where it may be necessary to make slight variations from standard in the ear hook, transmission tube, and earmould. It also gives some idea of variations in response due to changes in electrical drive source impedance.

For the tests showing the effects of varying the acoustic coupling the drive was kept standard at 1mW Maximum Available Power. (i.e. 1.73V rms via 750 Ohms and 1.4 mA d.c.). See Figure 9 for acoustic coupling arrangement.

Fig. 1.

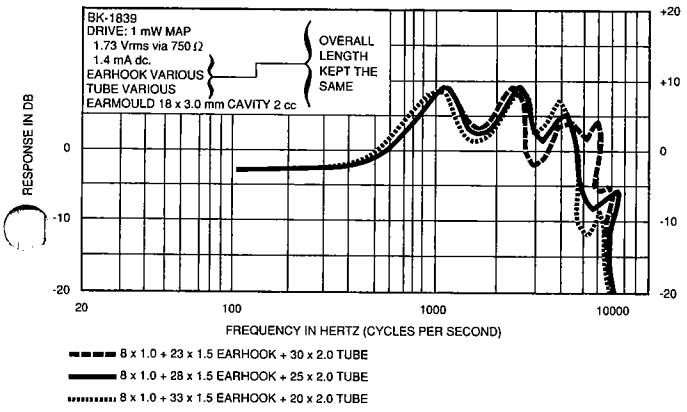


Figure 1 shows the changes in response by varying the length of the ear hook. The length of the transmission tube was changed to maintain the same overall length. Assuming that in practise the length of the transmission tube would be reduced if the ear hook were increased and vice versa.

Note:
0= 115 DB ABOVE 0.0002 MICROBAR
(2 X 10^{-5} N/m^2) on all graphs figures 1 to 8.

Fig. 2.

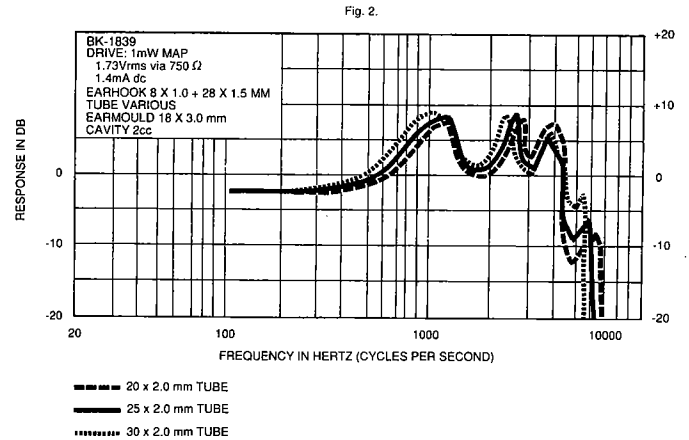


Figure 2 shows variations in transmission tube length only. These could be the kind of differences to be expected when fitting the hearing aid.

KNOWLES ELECTRONICS, INC.
1151 Maplewood Drive,
Itasca, Illinois 60143, U.S.A.
Phone: (708) 250-5100
Fax: (708) 250-0575
Telex: 433-0330

KNOWLES ELECTRONICS CO.
73 Victoria Road, Burgess Hill,
West Sussex. RH15 9LP, England.
Phone: (0444) 235432
Fax: (0444) 248724
Telex: 87460.

TB17

Figure 3 demonstrates the effect of reducing the internal diameter of the earmould only, which would be the case if the fitter ran the 2 mm transmission tube right through the earmould.

Fig. 3.

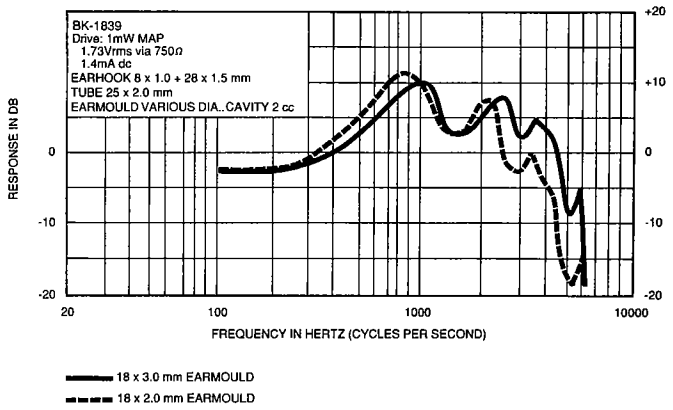
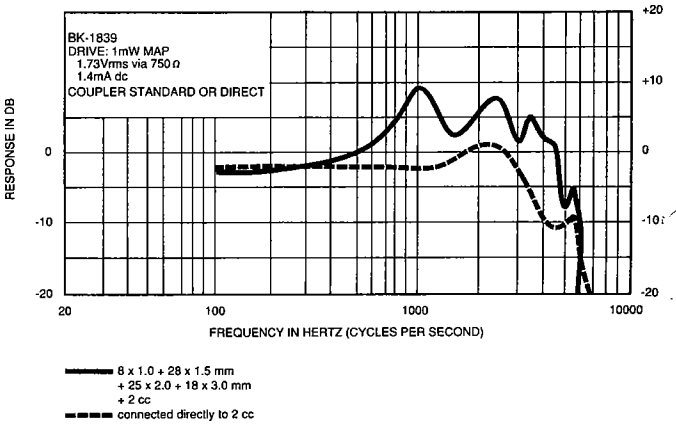


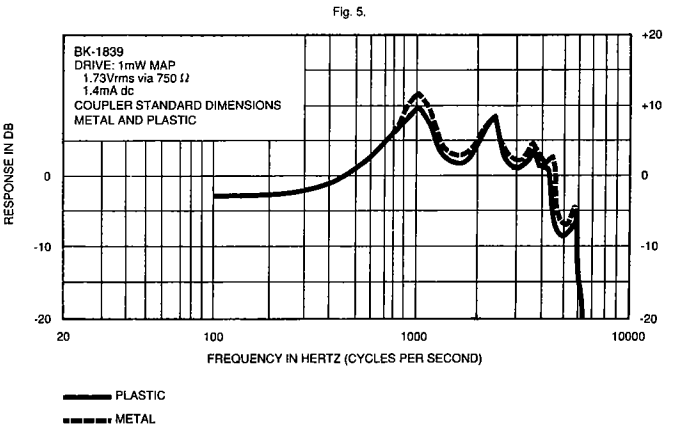
Figure 4 shows the transducer coupled directly to the 2cc cavity and the type of response one would expect with an 'in-the-ear' aid.
It can be seen from Figures 1-4 that the hearing aid designer and fitter have some degree of control over the final response by suitably arranging the coupling from the transducer to the ear.

Fig. 4.



Perhaps it should be mentioned at this stage that for production testing of receivers Knowles use an all metal coupling system. The result when tested this way corresponds to the published typical response curve. In normal hearing aid applications plastic tubing will be used and due to the difference in acoustic properties of metal and soft plastic the response is slightly modified. The plastic tubing tends to give a loss at the 1000 Hz peak. See Figure 5. For the purpose of this report, however, all the results shown are for plastic tubing.

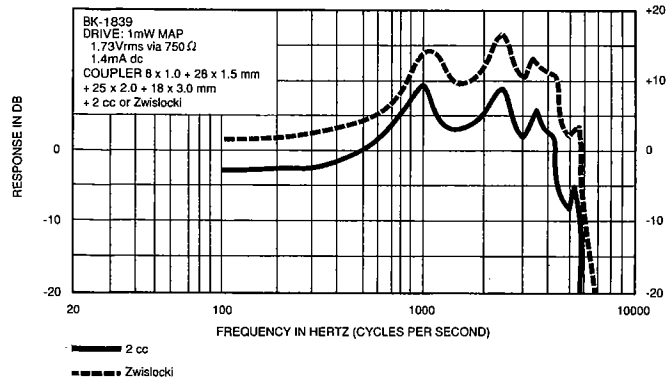
Fig. 5.



Knowles®

TB17

Fig. 6.



Keeping the connecting tubing as standard but changing the 2 cc cavity for a Zwislocki coupler gave the effect shown in Figure 6. This is considered, at present, to give a closer indication of the actual sound pressure level that would be experienced at the ear drum.

Fig. 7.

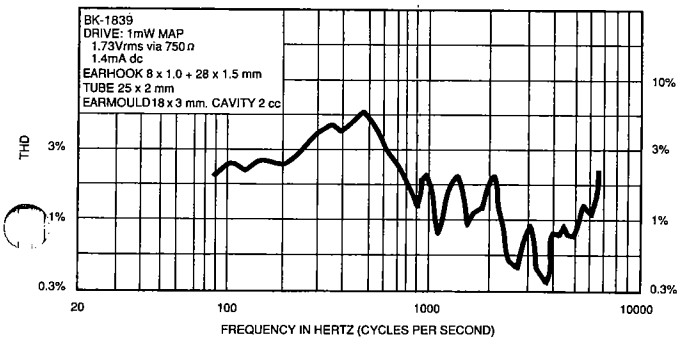


Figure 7 gives some indication of the total harmonic distortion characteristic under standard drive and acoustic coupling conditions for a typical receiver. The highest distortion is to be found around 500 Hz and can be as high as 10 per cent.

Fig. 8.

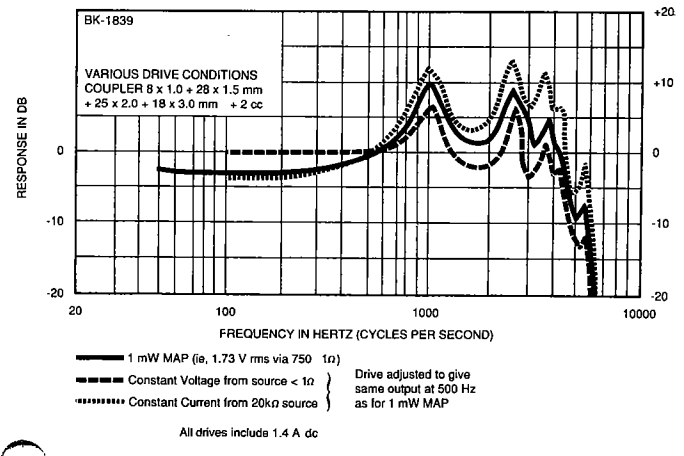


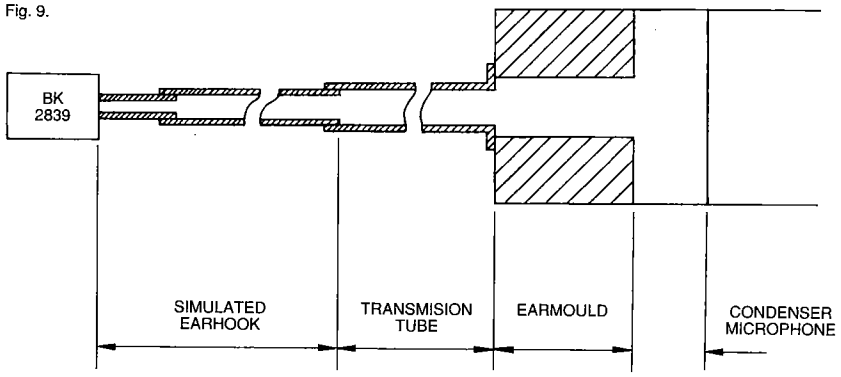
Figure 8 shows the effect of driving the unit from various source impedances. The drives for high impedance source and low impedance source were adjusted for the same sound pressure level at 500 Hz as for the 750 ohms source.

Some of the above tests have already been discussed in a general way in Knowles Technical Bulletins TB6 'The effects of acoustical termination upon receiver response' and TB7 'The effects of source impedance upon receiver response'. It is suggested that these be consulted together with this report. The difference seen between Figure 1 of TB7 and Figure 8 of this report is due to the fact that the drives in TB7 were normalised to give the same sound pressure level at 1000 Hz whereas for this report it was found that a clearer picture could be obtained by normalising at 500 Hz.

TB17

Knowles®

Fig. 9.



1. SENSITIVITY IN dB RELATIVE TO .0002 MICROBAR (2×10^{-5} N/m²) FOR THE CONDITIONS SHOWN IN # 2 AND # 3 BELOW.

2. MEASUREMENTS MADE USING 8 mm x 1.0 mm ID + 28 mm x 1.5 mm ID. EAR HOOK SIMULATOR INTO 25 mm x 2 mm ID. + 18 mm x 3 mm ID. + 2CC CAVITY. (AS I.E.C. 126). (TK 1799 AND B & K DB 0138).

3. ELECTRICAL SIGNAL (1 mW OF MAP):
   SOURCE RESISTANCE: 750 OHMS.
   DC CURRENT: 1.4 mA
   OPEN CIRCUIT AC VOLTAGE: 1.73V RMS

4. NOMINAL IMPEDANCE:
   ACOUSTICAL CONDITIONS: SEE # 2 ABOVE
   ELECTRICAL CONDITIONS: SEE # 3 ABOVE
   IMPEDANCE AT 500Hz: 380 OHMS
   IMPEDANCE AT 1000Hz: 750 OHMS

5. TOTAL HARMONIC DISTORTION:
   ACOUSTICAL CONDITIONS: SEE # 2 ABOVE
   ELECTRICAL CONDITIONS:
   FREQUENCY: 500 Hz
   SOURCE RESISTANCE: 750 OHMS
   DC CURRENT 1.4 mA
   OPEN CIRCUIT AC VOLTAGE: 1.73V RMS
   DISTORTION 10% MAX

Note:
When test limits are used to establish incoming inspection acceptance/rejection criteria, correlation of test equipment with Knowles is also required for elimination of equipment and test method variations.

6. NOMINAL DC RESISTANCE @ 20°C: 250 OHMS

7. SENSITIVITY

FREQUENCY	MIN.	MAX.
200	108.0	114.0
400	109.5	114.5
550	-	117.0
600	112.0	-
750	114.5	122.5
900-1300	124.0	130.0
1500-1900	115.0	121.0
2100-2700	119.5	126.5
2700-3300	114.0	-
3300-3900	118.0	125.0
3900-4400	114.0	-
4400-5500	103.0	-

Fig. 10.