

Part 2b: How K-AMP circuitry was used in seven actual clinical situations

The K-AMP hearing aid: A wide range of fitting options

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Part 1 of this article gave an overview of what K-AMP® circuitry does, its features, and the benefits of these features for hearing-impaired persons. Part 2a offered a summary of how well the K-AMP high fidelity hearing aid works as demonstrated by the results of the first 70 units fitted. This part, Part 2b, discusses representative clinical cases.

The following seven patient fittings (Figs. 1 a-g) illustrate the wide range of fitting options produced by the K-AMP hearing aid with selective use of available options. For each case, the audiogram on the top illustrates the threshold, a preferred listening level (M=most comfortable listening level) and an uncomfortable listening level (U) by frequency. Target and measured real ear insertion responses (REIR) of the selected aid are shown in the middle graph. The target REIR (NAL-2) is the dark line and the measured REIR is shown with input signals (composite noise - Frye 6500) of 50, 60, 70 and 80 dB SPL. The REUR at 0° and/or 45° is also shown. A family of hearing aid frequency response curves on the 2 cc coupler, with the volume control at full-on-gain (FOG), is illustrated on the bottom. The composite noise input level varied between 40, 45, 50, 55, 60, 70, 80 and 90 dB SPL.

Case 1. The first case, VC, age 77, shown in Figure 1a, illustrates a flat moderate to severe sensorineural hearing loss with moderately reduced dynamic range (40-50 dB) and a preference for comfortable listening at about 20 dB SL on the left. Her speech threshold was 55 dB HL, and her speech recognition

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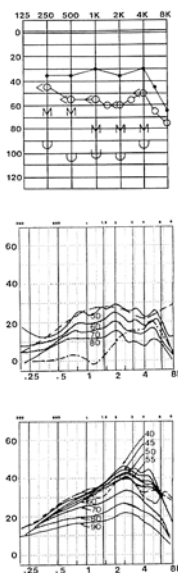


Fig. 1a

level dependent frequency response characteristic of the K-AMP.

VC was now able to converse easily with her husband and respond to his good sense of humor.

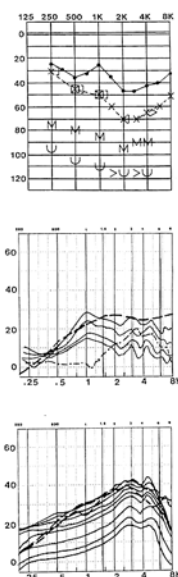


Fig. 1b

score was 76% (NU6).

She was fitted with an FFR K-AMP hearing aid; the LFC was full on and the TK was set for maximum gain and maximum high frequency boost for quiet sounds, or maximum compression, which is to say the lowest compression threshold or lowest compression knee point. The measured REIR of the aid meets the target REIR at low level input signals. The family of FOG frequency response curves illustrates the level dependent frequency response characteristic of the K-AMP.

Case 2. The second case, DLR, age 40, shown in Fig. 1b, illustrates a mild to moderate to severe notched sensorineural hearing loss with reasonably good dynamic range (@60 dB SL) and a preference for comfortable listening level at about 30-40 dB SL. He is a railroad operator who was having difficulty understanding speech in noise at work, as well as in normal domestic situations. His speech threshold was 15 dB HL, and speech recognition scores

were 90% (NU6).

He was fit monaurally (the other ear had a high frequency ski-slope loss and cost prohibited the recommended fit) with a K-AMP with LFC cut, a strong receiver (3075) and a 1 k ohm damper in the receiver tube. The TK circuit was set for maximum gain and high frequency boost for quiet sounds. The toggle switch for linear capability was disabled (preferred K-AMP only). The measured REIR of the aid meets the target REIR at low level input signals. The family of FOG frequency response curves illustrates the level dependent frequency response (high frequency) boost characteristic. He reported being better able to understand at work and at home with his hearing aid.

Case 3. The third case, EL, age 63, shown in Fig. 1c, illustrates a moderate low frequency to mild mid-frequency to moderate to severe high frequency sensorineural hearing loss with reasonable dynamic range (>50 dB SL in the region of the loss) and a preference for comfortable listening at about 40 dB SL. He is a manager of a heating/piping contracting company and a previous wearer of hearing aids. He had difficulty understanding speech in noise at work, especially because of the heavy demand for telephone use. His speech threshold was 45 dB HL and speech recognition score was 88% (NU6).

He was fit binaurally with K-AMP devices having internal modification of the low frequency response and a strong receiver; the TK option was set for maximum gain and high frequency boost for quiet sounds. The toggle-to-

EDITOR'S NOTE: In Figs. 1 a-g, representative cases illustrate K-AMP fittings. On the top, the audiogram illustrates threshold, preferred listening level (M) and uncomfortable listening level (U) by frequency. In the middle, real ear insertion response (REIR) is shown: Target REIR (NAL-2) with a dashed line and measured REIR with a solid line for different input levels (composite noise-Frye 6500) of 50, 60, 70 and 80 dB SPL. The REUR is a dot-dash line. On the bottom, a family of full-on-gain (FOG) frequency response curves on the HA-1 2 cc coupler is shown.

K-AMP case histories

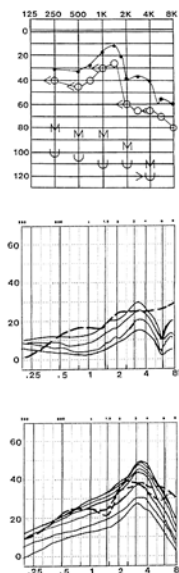


Fig. 1c

Case 4. The fourth case, JR, age 51, shown in Fig. 1d, illustrates *normal low frequency hearing with a mild to moderate to severe high frequency sensorineural hearing loss* with moderately reduced dynamic range (40 to 50 dB SL in the region of the loss) and a preference for comfortable listening at about 20 dB SL. He is a computer programmer and systems manager who was having difficulty understanding speech in noise at work, as well as in normal domestic situations. His speech threshold was 15 dB HL, speech recognition score was 86% (NU6), MCL for speech 55 dB, and UCL for speech 90 dB.

He was fitted binaurally with K-AMP instruments with LFC cut and mild receivers (3073); the TK option was set for maximum gain and high frequency boost for quiet sounds, and the toggle-to-linear capability was disabled (preferred K-AMP only). The measured REIR of the hearing aid exceeds the target REIR at low level input signals and meets target REIR with inputs of 60-70 dB. The family of FOG frequency response curves illustrates the level dependent frequency response and extended high frequency boost characteristic of the K-AMP.

Fig. 1d

linear capability was disabled (preferred K-AMP only, especially for the phone). The REIR of the aid meets the target REIR at low level input signals. The family of FOG frequency response curves illustrates the level dependent frequency response/extended high frequency boost characteristic of the K-AMP.

He reported that the devices provide better performance than his prior hearing aids, and he wears them all day, every day.

was very satisfied with the natural sound and had very little need to adjust the volume control.

Case 5. The fifth case, RL, age 80, shown in Fig. 1e, illustrates *normal low frequency hearing with a mild to severe high frequency sensorineural hearing loss* with moderately reduced dynamic range (40 to 50 dB SL in the region of the loss) and a reduced preference for comfortable listening at about 15 dB SL. He is a retired teacher who was having difficulty understanding speech in normal domestic situations. His speech threshold was 30 dB HL; his speech recognition score was 50% (NU6) @35 dB SL and 68% @45 dB SL. He was fitted binaurally with K-AMP devices with LFC cut, moderate output receivers (3074), the TK set for maximum gain and high frequency boost for quiet sounds, 1 k ohm damper in the receiver tube and the toggle-to-linear capability disabled (preferred K-AMP only). The measured REIR of the aid exceeds the target REIR at low level input signals and meets target REIR with inputs of 50-60 dB. The family of FOG frequency response curves illustrates the level dependent frequency response and extended high frequency boost characteristic of the K-AMP circuit.

Fig. 1e

Both RL and his wife noticed a significant improvement in his ability to follow and participate in conversation.

Case 6. The sixth case, FMcD, age 53, shown in Fig. 1f, illustrates *a severe ski-slope high frequency sensorineural hearing loss* with narrow dynamic range (30 dB SL in the region of the loss) and a preference for comfortable listening at about 10 dB SL. He had difficulty understanding conversation in small groups. His speech threshold was 15 dB HL, speech recognition score was 74% (NU6), and MCL for speech was 75 dB.

He was fit binaurally with K-AMP instruments having internal modifications introduced by the manufacturer to reduce low frequencies, LFC control, strong receiver, TK set for maximum gain and high frequency boost for quiet sounds, 1500 ohm dampers in the receiver tubes and 300 ohm dampers in the vents. The

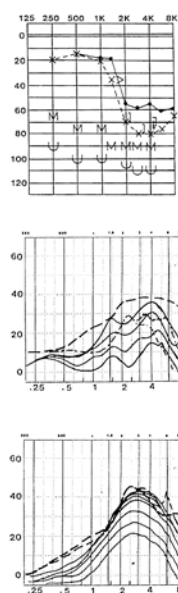


Fig. 1f

measured REIR of the hearing aid falls slightly short of the target REIR at low level input signals of 50 dB SPL. The family of FOG frequency response curves illustrates the level dependent extended high frequency boost characteristic of this variant of the K-AMP circuit.

He reported that he could hear better and enjoy television with his wife.

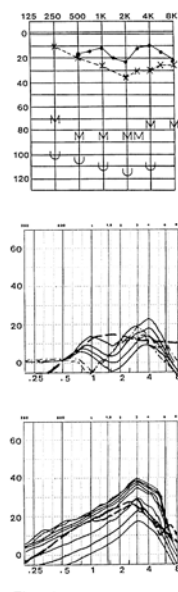


Fig. 1g

Case 7. The seventh case, PN, age 61, shown in Fig. 1g, illustrates *a mild, high frequency sensorineural hearing loss* with good dynamic range (85 dB SL uncomfortable listening level) and a preference for comfortable listening at about 65 dB SL on the left. Her speech threshold was 10 dB HL, speech recognition scores were 92% (NU6), MCL for speech was 80 dB HL, and UCL for speech was 105 dB HL. She is a psychologist who finds that she missed some of her patients' conversation and was beginning to experience slight difficulty in daily communication situations.

She was fitted with binaural K-AMP instruments with LFC partially reduced and TK adjusted close to maximum compression to slightly reduce the gain and high frequency boost. The measured REIR of the hearing aid was smooth in the right ear but less smooth in the left ear. The REIR dips below and then exceeds the target REIR at low level input signals. The dip around 2 kHz may occur as a result of the broad real ear unaided response (REUR) with significant enhancement at 2 kHz. The family of FOG frequency response curves illustrates the level dependent frequency response characteristic of the K-AMP circuit on the 2 cc coupler.

She reports using her hearing aids all the time; they help in her office to hear patients' conversation. □