Transmission measurements using high purity aluminum were made on different field locations for diagnostic x-rays from 50 to 125 kVp. A collimation system with movable jaws was used to obtain good geometry(very low scatter) at the different locations. The transmission measurements were utilized as input for a variational algorithm to obtain the exposure x-ray spectrum, R per keV energy interval. The algorithm utilizes a pre-spectrum or assumed spectrum to start and then calculates the transmission and compares it to the measured transmission values. At each energy interval the assumed spectrum is perturbed by different amounts, both plus and minus, and a new transmission spectrum is calculated for the perturbations. The spectrum yielding a smaller difference between the calculated and measured transmission is selected and the process continued. When characteristic x-rays are present, a value obtained from theory for characteristic intensity is added to the pre-spectrum. The method yields calculated transmission curves differing from the measured transmission curves by less than 1% and shows the change in spectra across the x-ray field. The heel effect is demonstrated by the hardening of the beam as one moves from the cathode to the anode side.