Five different combinations of digital shaping parameters were tested for a newly assembled, ^{109}Cd source, K X-ray fluorescence bone lead system. Lead concentration in bone may be measured by detecting characteristic lead X-rays and coherently scattered photons, using a high purity germanium radiation detector. System calibration results will be presented, together with analyses of measurement uncertainty and reproducibility obtained from repeat measurements of a bone phantom and a human tibia. Of the combinations tested, digital shaping parameters of 2.4 μs for a rise time/fall time and 1.2 μs for a flat top width were identified as superior. The digital system provided improvements in measurement precision of at least 25% when compared with previously reported conventional system results.