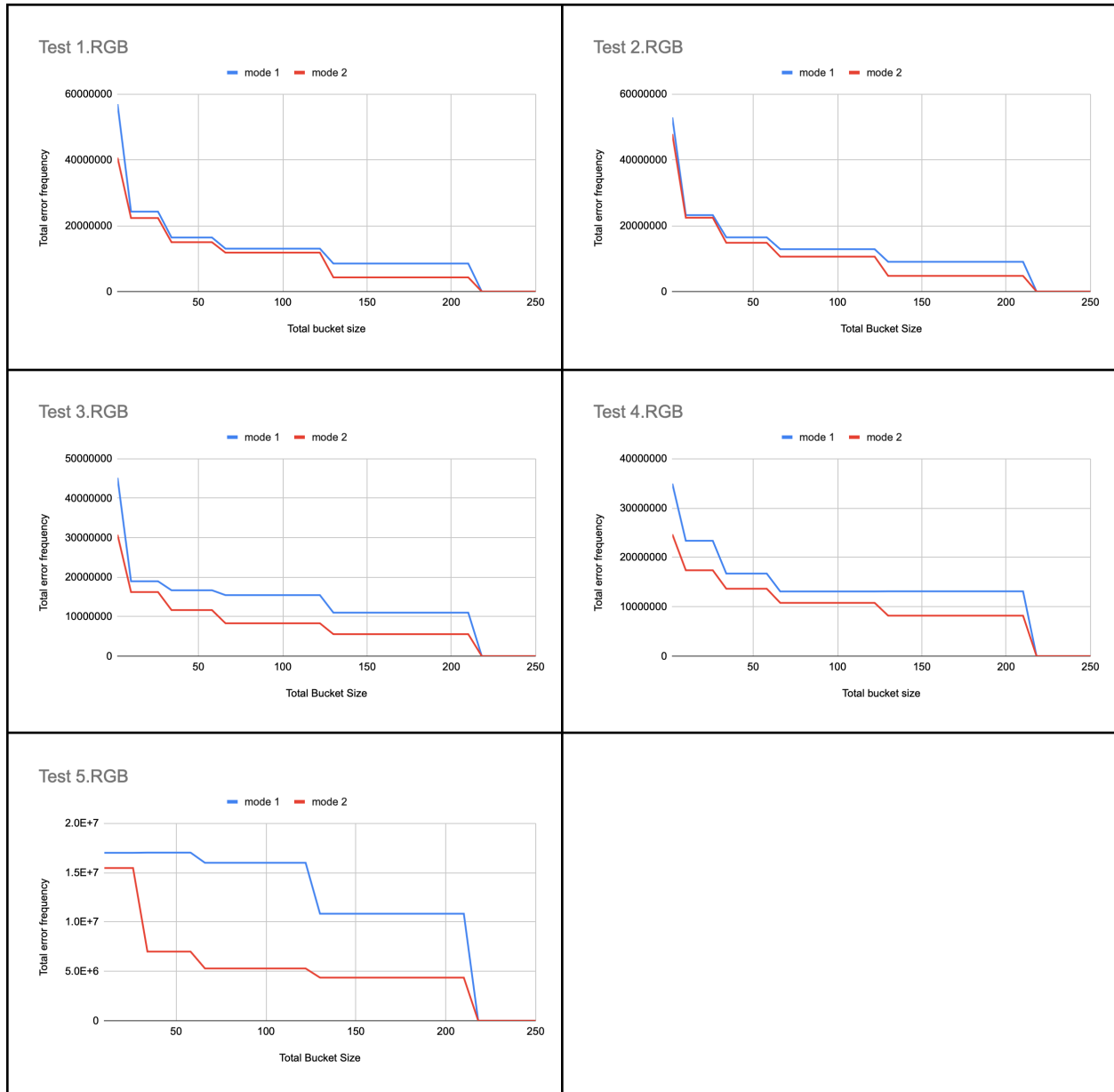


Total Error Analysis



In all five test scenarios, mode 2 (non-uniform quantization) demonstrates a consistent ability to achieve lower total error rates compared to mode 1 (uniform quantization). This pattern underscores non-uniform quantization's greater efficacy in minimizing total errors for the RGB test cases examined. An observable

trend across these scenarios is the reduction in total errors as the number of buckets increases, particularly where bucket sizes reach 256^3 . At this point, the quantized image essentially replicates the original image, bringing the total errors down to zero.

Unlike uniform quantization, which employs a consistent bit allocation across all quantization levels irrespective of their frequency or significance, non-uniform quantization excels in its adaptive approach. It allows for buckets to vary in size, determined by averages in the calculated histogram, thus mapping values with greater precision and improving accuracy. This method acknowledges the varying significance levels within the signal, allocating more bits to values deemed more important based on their occurrence or impact.

This differential bit allocation mechanism inherent in non-uniform quantization renders it superior for signals of varying importance levels. By adjusting the size of buckets to match the averages found in the histogram, non-uniform quantization enables a more nuanced and accurate representation of the signal. This feature is particularly beneficial in applications such as image and video processing, where the fidelity of the signal's representation directly impacts the quality of the visual output.

By concentrating more bits on significant values, non-uniform quantization not only lowers the total error but also significantly enhances signal quality. Thus, non-uniform quantization (mode 2) proves to be more effective than uniform quantization (mode 1) in reducing total error frequencies for RGB test cases. Its capability to adapt bucket sizes based on calculated averages and to map values more precisely marks a distinct advantage, especially for signals with diverse importance levels, reinforcing its effectiveness across multiple tests.