KONICA MINOLTA

Flicker Measurement
of Variable Refresh Rate (VRR) Display

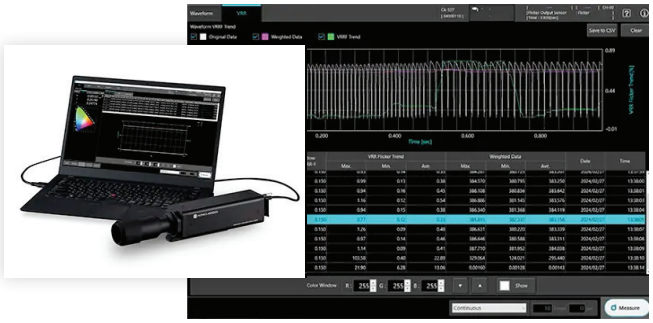
Variable Refresh Rate (VRR) technology represents a significant advancement in display technology, dynamically adjusting the refresh rate of monitors, laptops, TVs, smartphones, and similar devices in real-time to align with the frame rate of the displayed content. This synchronization minimizes visual artifacts such as screen tearing and stuttering, leading to a smoother and more immersive viewing experience, particularly in gaming and high-paced video content.

Moreover, one of VRR's primary benefits is power efficiency. When viewing static content, such as images or web pages, the refresh rate can be lowered to decrease power consumption, thus improving battery performance. By allowing the display to refresh at variable rates rather than adhering to a fixed rate, VRR enables a more seamless and fluid motion, thereby enhancing the overall quality of the visual experience.

While VRR technology offers significant benefits, it also presents a potential drawback known as VRR display flicker. This flicker manifests as noticeable fluctuations in brightness or image stability that occur when the refresh rate adjusts dynamically. Such variations can be distracting and may cause visual discomfort, particularly during scenes with subtle or gradual changes in brightness. VRR display flicker can occur in various display technologies, such as OLEDs, LCDs, etc., where rapid refresh rate adjustments can create uneven luminance, making the flicker more noticeable.

Challenges
in Measuring Flicker in VRR Displays

Measuring VRR (Variable Refresh Rate) display flicker is crucial for manufacturers aiming to provide consumers with a consistent and comfortable viewing experience. Flicker can significantly affect user satisfaction and visual comfort, making accurate measurement methods essential. Over the years, several flicker measurement techniques have been developed, with the JEITA (Japan Electronic Information Technology Association) flicker method emerging as one of the most widely utilized approaches. This method is particularly effective for displays with a static refresh rate, where the waveform is predictable and periodic.



However, the JEITA flicker method falls short when applied to VRR displays, which are designed to adapt their refresh rates dynamically to match the content being displayed. Unlike static displays, VRR displays exhibit an aperiodic and more complex waveform, complicating flicker measurement. Additionally, the JEITA flicker method focuses on a single frequency component, such as 30Hz, limiting its effectiveness. In contrast, VRR displays can exhibit a combination of multiple frequency components, for example, 30Hz combined with 20Hz, making flicker measurement more challenging.

Konica Minolta Sensing
Display Metrology Solutions for VRR Displays

To effectively address the challenges associated with measuring flicker in Variable Refresh Rate (VRR) displays, Konica Minolta Sensing has developed the Display Colour Analyzer CA-527. This innovative display measurement instrument enables accurate and reliable measurement of flicker in VRR displays, offering manufacturers crucial insights that can significantly enhance the visual performance of their products.

The Display Colour Analyzer CA-527 features a VRR flicker measurement function designed to enhance the accuracy of flicker assessments of VRR display. Unlike traditional methods that operate in the frequency domain, it convolves the Temporal Contrast Sensitivity Function (TCSF) in the time domain based on IEC 62341-6-3, offering a more robust and consistent flicker measurement. Also, it accounts for the interaction between different frequency components, further enhancing its effectiveness.

In addition to its specialized capabilities for measuring VRR flicker, the Display Colour Analyzer CA-527 offers a variety of other flicker measurement methods to meet diverse requirements. These methods include JEITA, VESA (Video Electronics Standards Association), and FMA (Flicker Modulation Amplitude) techniques. The Display Colour Analyzer CA-527 also boasts extensive capabilities in measuring luminance and chromaticity across a wide dynamic range, which is ideal for evaluating the luminance and chromaticity uniformity, colour gamut, contrast ratio, etc., of the latest OLED and micro-LED display technologies.

Beyond the Display Colour Analyzer CA-527, Konica Minolta Sensing offers an extensive selection of display metrology solutions, including spectroradiometers, imaging photometers/colorimeters, and luminance colour meters, catering to a wide array of display testing and evaluation needs.

For further details on the Display Colour Analyzer CA-527 or assistance selecting the right display metrology solutions for your applications, please don’t hesitate to contact us for a consultation to help you explore your options and ensure you find the perfect solution to meet your needs.