What are the HDMI and Related Video Resolution Specifications for the SPA25 Prisma and SP25 Prisma?

Primare's home cinema line is designed for both cinephile and audiophile, with SPA25 Prisma multi-channel integrated amplifier and SP25 Prisma multi-channel preamplifier processor composed of carefully considered and crafted features and functionality to provide the best home cinema experience for the greatest number of people.

As a result, the SPA25 Prisma and SPA25 Prisma will feature eARC from the HDMI 2.1 build list and HDMI 2.0b specifications of 4K 60 Hz UHD HDR video switching, including Dolby Vision, HDR 10, and HDR 10+, but will not have 4K 120 fps or 8K 60 fps capabilities.

Design Considerations
This video design choice was made purposefully, as when we began the design effort several years ago now, we lacked confidence in the then available chip sets being able to provide the performance claimed and being readily available for production by a small manufacture like us, particularly given current semi-conductor supply shortages. This in hindsight has proven to be a wise choice given that at least one of the first available chips had a serious flaw preventing it from functioning at full specified resolution.

With this in mind, we asked ourselves a series of questions based on our practical design approach to determine if the additional cost to our customers and risk to us as a manufacturer would provide significant useful benefits:

- What are the essential features found in the HDMI 2.1 for a high-performance home cinema?
  As most of the features included in the HDMI 2.1 build list are related to high resolution and high-speed or high frame rate gaming conditions, eARC appeared to be the only essential feature for high-performance home cinema, which we have included in our SPA25 Prisma and SP25 Prisma models.

- What are the cable and connection limitations?
  Cable length recommendations vary, but the length limit for an HDMI copper cable is anywhere from one meter to five meters. This length limitation can be overcome with HDMI extenders or amplifiers, or by using fibre-optic cable connection. None-the-less this indicates to us that the HDMI 2.1 signal should be run only in the shortest lengths possible, avoiding any unnecessary cables or connections in getting the video signal to the display.

- Are there any potential conflicts between HDMI 2.1 features?
  There can be conflicts among the various features available with HDMI 2.1. For example, VRR and HDR do not mix well, and if you activate them together VRR can adversely affect the related display backlight systems and reduce the quality of the HDR image, and in fact Dolby Vision may turned off with VRR turned on.

- Are there many games that can consistently provide this level of playback?

No, in fact even for those that provide this level of performance many must throttle or reduce resolution and frame rate during episodes of more intense game play to avoid latency and buffering.

- Are there game consoles that can consistently provide this level of playback?
  No, even ten years after the initial announcement of ultra-high resolution and high frame rate gaming, most current consoles are unable to play completely the handful of UHD games available.

- Is serious gaming played in a home cinema context?
  Player versus Player (PvP), especially at higher resolutions and frame rates, are nearly invariably played using purpose built, highly sophisticated gaming computers with associated gaming displays and headphones complete with microphones for player communication. Even with this equipment, most serious gamers downgrade resolution to 4K 60 or even 4K 30 to ensure consistent game play. Party games, those that would be more commonly played in a home cinema system context, are rarely if ever above 4K 30 in resolution, and often only available in HD.

- Does the artwork benefit from higher resolution and frame rates, or does the higher resolution only serve to reveal the limitations of the game's visual design?
  This is the struggle for most game design companies, in that the artwork can often be betrayed by a higher resolution, revealing some of the flaws in an otherwise beautiful design. The best example of this phenomena might be Peter Jackson's decision to film The Hobbit: An Unexpected Journey in 48 fps, with the results meeting with sharp criticism due to the non-cinematic HD video look that many were dissatisfied with as it in part revealed all too clearly makeup, such as prosthetics, and wigs, that may not have been so readily apparent with the standard 24 fps. For the second instalment, The Desolation of Smaug, Jackson softened the image and made it look more cinematic.

Further Considerations

Malmö, where we are based, is a game development centre, and in discussions with various game designers and directors of gaming culture, the answers to our questions were confirmed, in that they agreed that high-resolution specifications promoted by the video and gaming hardware industries were not generally realisable.

According to them, the games themselves were proving difficult to design to deliver those higher resolutions while also maintaining backward compatibility. This was true for even the most advanced gaming platforms currently available, as they were proving to be unable to handle the higher resolutions and frame rates effectively, leading to throttling, oddly enough just as the action increased and the higher resolution may have been most needed.

Recommendations for High Resolution and High Frame Rate Gaming Connection

Our recommendation and that of the game developers we consulted is to use direct video connection of the gaming console to the display, with audio output from the display connected to the processor by eARC (that is if you aren't using gaming headphones), with the thought that this provided the best chance to achieve the higher resolutions, that is if the display itself is in fact up to the task. And even in those cases, the suggestion was to lower the resolution to ensure consistent play.

In effect, this is a general recommendation we have been making for over a decade. During the transition from SD to HD video it was readily apparent that best video results

could be achieved with a dual connection scheme from a DVD or Blu-ray disc player, with separate and direct connection to the video display and audio processor, bypassing the unnecessary additional connections and circuitry for video signal.

A word of caution
We recommend that the specifications of any product under consideration be examined carefully, as it is up to the device manufacturer to decide what HDMI features are incorporated. A device listed as HDMI 2.1 may not support all related features or have certain limitations, such as compressed video where uncompressed video performance might be assumed. This is the reason that the HDMI organization does not want manufacturers indicating features and specifications with the build list number only. To quote from the HDMI organization website:

> "Can I use HDMI 2:1a in my marketing?
> You can only use version numbers when clearly associating the version number with a feature or function as defined in that version of the HDMI Specification. You cannot use version numbers by themselves to define your product or component capabilities or the functionality of the HDMI interface.
>
> And please note that NO use of version numbers is allowed in the labeling, packaging, or promotion of any cable product."
>
> https://www.hdmi.org/spec/hdmi2_1

For the Future
There may be concerns that the SPA25 Prisma and SP25 Prisma lacking HDMI 2.1 capabilities will too quickly become outdated as new features and functionality will undoubtedly be introduced in the years ahead. However, as we look to the recent past and scan the horizon for hints of future developments in video technology, we see the trend of having the video display be the main source for the highest resolution video only continuing. The result is that the role of the multi-channel preamplifier and integrated amplifier will predominantly be audio processing, with eARC providing the connection between audio and video components.

In fact, evidence of this already occurring can be found in the many of our customers continuing to use with great satisfaction older generation Primare processors and integrated amps, some with only SD quality video switching, in their current systems because of the high-quality amplification and great sound that they still provide with video sources connected directly to their displays.

That said, it would seem we can now be more confident in the quality and supply of the latest generation of chips, and that conditions will further improve with more sophisticated game development and the introduction of the long awaited new versions of PlayStation and Xbox consoles, we have pushed back the launch of our reference SP35 Prisma processor to include the higher video resolution capabilities among other more advanced features, expected to be released at the end of 2023 or early 2024.

Additional Information
- For more information about HDMI 2.1 see the HDMI organisation website linked above.
- For information regarding the state of high resolution and high frame rate gaming, we recommend reading the What HiFi article linked here:

https://www.whathifi.com/features/the-myth-of-4k-gaming-most-4k-games-arent-really-4k-and-thats-not-getting-better