**3GPP TSG-SA WG4 Meeting #123S4-230489**

**Online, 17th April 2023 - 21th April 2023**

**Source: China Mobile Com. Corporation**

**Title: Colour Conversion Module for Image Processing**

**Agenda item: 9.5**

**Document for: Discussion and Agreement**

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# Introduction

In this contribution, we proposed a colour conversion module for image processing

# Colour Conversion Module

Colour Conversion is essential for various use cases, such as raster-based split rendering as defined in TR 26.928 clause 6.2.5. In this case, colours for the frame buffers are typically RGB, which means that a conversion from YUV to RGB is necessary when using regular video codecs. Due to the size of the frame buffers, this conversion may not be efficient enough on the CPU. Therefore, it is recommended to implement this conversion on the GPU. Another example is for *Device design type 4*, some encoders may not directly support RGBA. the extended colour conversion module in combination with available acceleration frameworks (e.g., NDK) may also be needed.

YUV, which stands for luma (Y') and chroma (U, V), can be further subdivided into various planar and storage formats such as YUV I420, YUV420sp (NV12), YUV420sp (NV21) and others. A generic YUV format, capable of describing any 4:2:0 chroma subsampled planar or semi planar buffer (but not fully interleaved), is an 8 bits per colour sample. The conversion between RGB and YUV color spaces can be carried out based on the conversion formulas defined in BT.601, BT.709, and BT.2020 in order to calculate each Y, U, V values, and the alpha\_channel can be support as additional transparency information.

## An example of color conversion procedures for *Device design type 4* descriptions as follows:

1. The XR Runtime sends the rendered frame to the color conversion module.
2. The color conversion module gets the pixel data of the rendered frame by copying it into a provide bitmap.
3. The color conversion module uses the RGB to YUV conversion formula to convert the R, G, B value into the Y, U, V value. The alpha\_channel value is set to be 0 as a typical LCD screen of current smartphone devices, used as an optical transmitter, is based on a RGB\_888 color space system.
4. Finally, the color conversion module follows the YUV storage format to store the Y, U, V values..

# Proposal

We propose to include section 2 of this document into the MeCAR permanent document as a colour conversion module for image processing.

# References

1. 3GPP TR 26.928: "Extended Reality (XR) in 5G".
2. 3GPP TR 26.998: "Support of 5G Glass-type Augmented Reality / Mixed Reality (AR/MR) devices".
3. 3GPP TSG SA WG4 S4-230307, “MeCAR Permanent Document v5.0.0”, February 2023.
4. ITU ITU-R Recommendation BT.601 “Studio encoding parameters of digital television for standard 4:3 and wide screen 16:9 aspect ratios ”
5. ITU ITU-R Recommendation BT.709 “Parameter values for the HDTV standards for production and international programme exchange”
6. ITU ITU-R Recommendation BT.2020 “Parameter values for ultra-high definition television systems for production and international programme exchange”