RZ/V2H, RZ/V2N ISP SUPPORT PACKAGE GUIDE

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RENESAS ELECTRONICS CORPORATION

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ISP SUPPORT PACKAGE OVERVIEW

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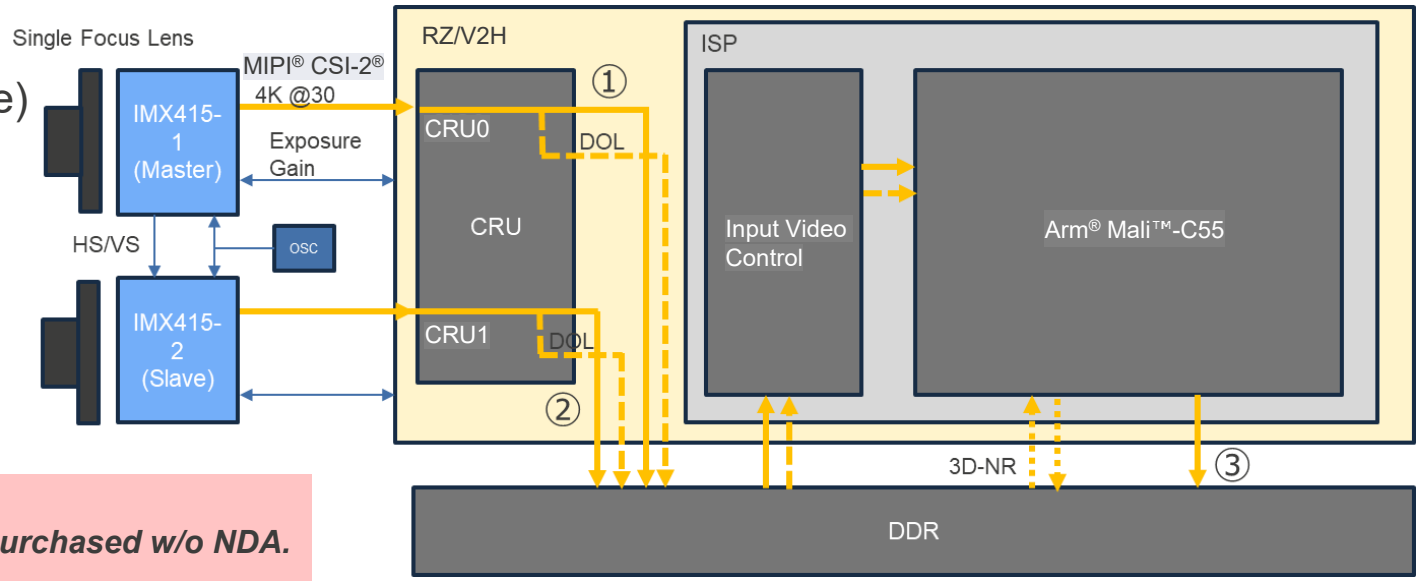
- The ISP support package is a package for customers' development with ISP on RZ/V2H or RZ/V2N included a reference sample software, documents, and image quality tuning tools. With the sample software, you can verify the following functions.

- With one or two Sony IMX415 CMOS sensors, the sample software can capture RAW images, process by ISP on RZ/V2H or RZ/V2N and stores images in RGB or YUV in DDR populated on the Evaluation Board Kit.

- Major functions
  - Maximum image size 4K 30fps
  - AE (Auto Exposure)/AWB (Auto White Balance)
  - High Dynamic Range
    supporting Tone mapping and DOL
  - Resize (downscale only) and crop
  - Output format: YUV422 or RGB888

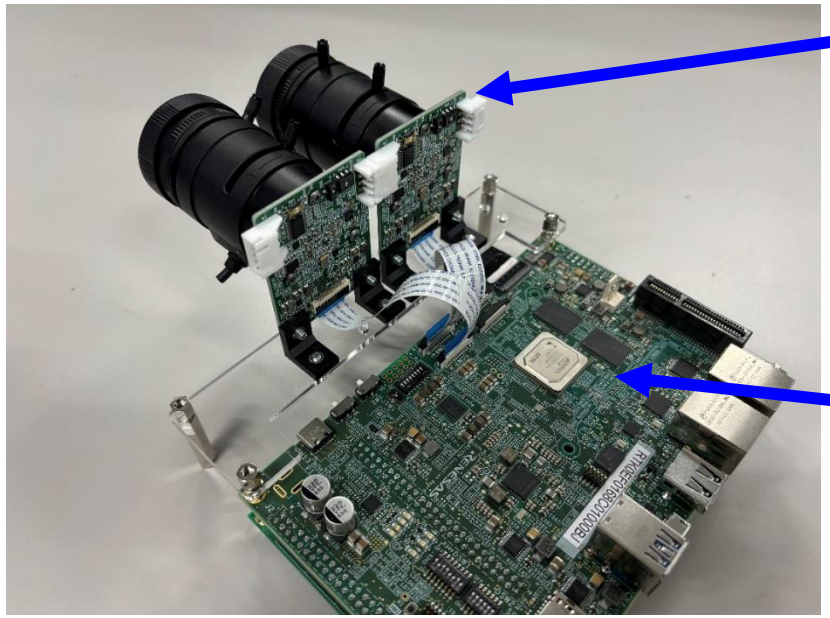
Scope of ISP support package



Note)
The camera modules with using ISP on RZ/V device can be purchased w/o NDA.
Please refer to RZ/V available partner camera module list

ENVIRONMENT

- ISP support package operating environment
  - Board : RZ/V2H: RZ/V2H-EVK, RZ/V2N: RZ/V2N-EVK
  - Sensor : SONY IMX415:
    CSM.SOL: IMX415 Board-M12 (M12 lens mount with a lens attached)
    IMX415 Board (CS mount without lens)
    or User compatible board



CONDITION OF USE

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❑ Purpose of ISP support package

- **ISP support package is intended to support customers' product development using ISP on RZ/V2H or RZ/V2N, but it does not guarantee its quality or performance.**

❑ Condition of distribution

In order to provide ISP support package, the following conditions must be met.

- **Arm's approval**
  - Arm's competitors and embargoed manufacturers are not approved.
  - In the case of a special dealer, approval will not be granted unless the purpose of use and support destination are clarified.
    This is because there is a concern about disclosure to an unspecified number of people.
- **NDA with Renesas - ISP support package is controlled under NDA.**
- **Agree to the license agreement- Automatically processed when downloading from a secure site.**

❑ Prohibitions

Secondary distribution from customers, partners, distributors, or Renesas employees*

*Limit the distribution to secure sites only to strictly enforce our contract with Arm.

HOW TO GET ISP SUPPORT PACKAGE

- Sign an NDA between customer and Renesas
- Customer make a download request from RZ/V2H or RZ/V2N.
- Renesas will contact to you for customers' information to get Arm's approval.
- Customer can get ISP support package from secure site with the agreement of terms and conditions.

Required information
- ✓ Official company name
- ✓ Corporate location and address
- ✓ Main website
- ✓ Brief description of end apps

SUPPORT POLICY AND SUPPORT PARTNERS

❑Support Policy

- **Supported**
  - **ISP support package Q&A and troubleshooting**
- **NOT supported**
  - **Customization such as sensor change etc.**
  - **Image quality tuning**

***All requests that are not supported should be directed to a support partner.**
***Tuning Guide (Training videos) is provided under NDA and Arm's approval.**

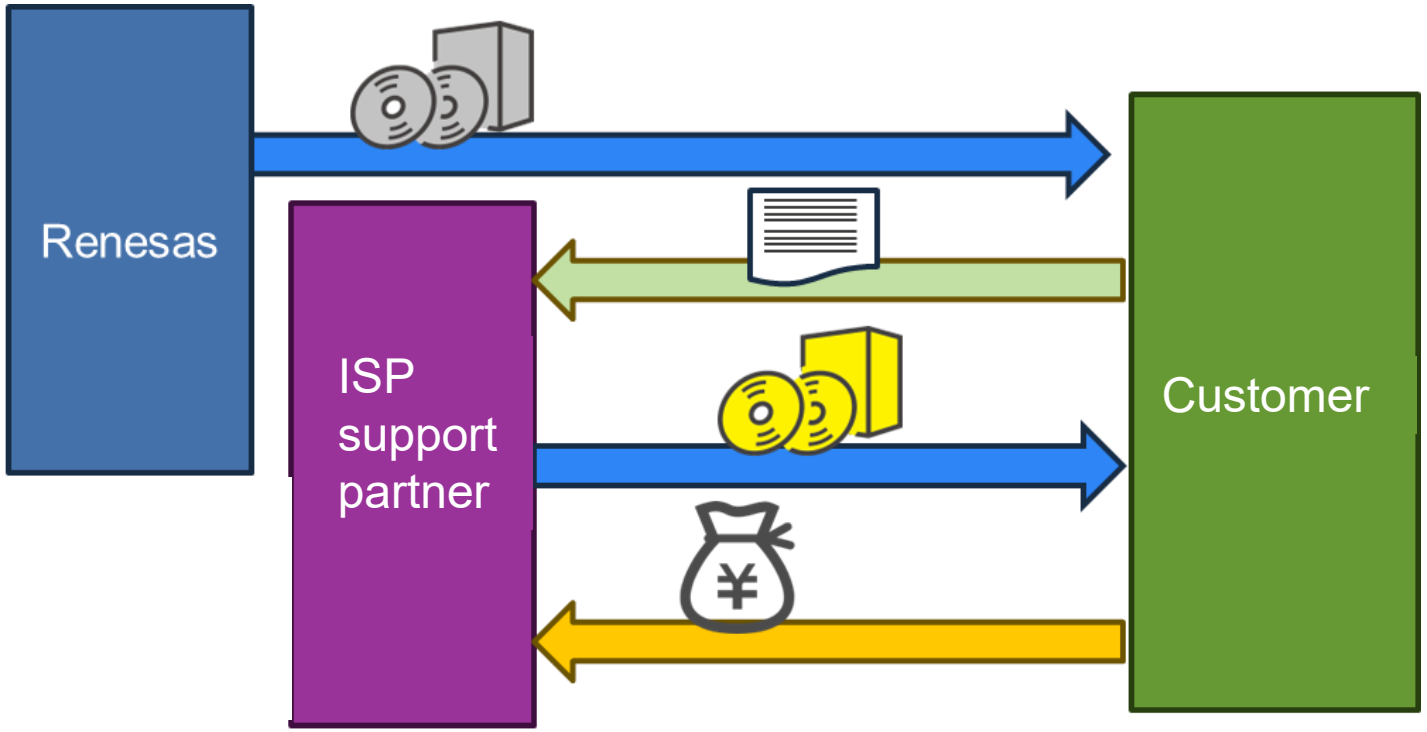
❑Support Partners

- **Thundersoft Japan Co., Ltd.**
  Name: Hiroaki Naganuma
  e-Mail: hiroaki.naganuma@thundersoft.com

to be increased more support partners in the future

PARTNER'S ISP SUPPORT MODEL

Arm accepted following ISP support model by ISP support partner to avoid violation of secondary distribution.



1. **Customer requests Renesas to provide ISP support package.**
2. **Customer directly contract to ISP support partners for technical support or camera customization.**
3. **Customer and ISP partners align cost, term support etc. Renesas doesn't be involved.**
4. **ISP support partners provide dedicated support to customer included software release.**

PARTNER'S SUPPORT MENU OF THUNDERSOFT

Development Support Menu

No.	Menu	Work Details
1	Basic Camera integration package	a) sensor driver (no EEPROM, no AF, no LED) b) basic tuning using MMS objective criteria
2	Middle Camera integration package	a) sensor driver b) EEPROM driver c) AF driver d) LED driver e) basic tuning using MMS objective criteria
3	Multi camera package (two image sensors, no HW synchronization)	a) sensor #1 driver (no EEPROM, no AF, no LED) b) sensor #2 driver (no EEPROM, no AF, no LED) c) basic tuning using MMS objective criteria
4	Multi camera package (two image sensors, HW synchronization)	a) sensor #1 driver including (EEPROM, AF, LED) b) sensor #2 driver (EEPROM, AF, LED) c) sensor HW synchronization d) basic tuning using MMS objective criteria
5	Custom package	Develop with customer's needs (PoC～System Development)

DETAIL OF ISP SUPPORT PACKAGE

CONTENTS OF ISP SUPPORT PACKAGE CONTENTS

RZ/V2H ISP Support Package | Renesas RZ/V2N ISP Support Package | Renesas

	Deliverables	Class	Contents	Notes
1	Document	Arm's Document	Release notes Software technical reference manual Calibration tool guide Control tool guide	—
		ISP Document	ISP support package release notes ISP support package sample application release notes Software User's Manual	
		Other	Hardware User's Manual IMX415 reference circuit diagram Image Quality Tuning Guide	
2-1	Software	Driver source code recipe	V4L2 Device driver IV-CTRL driver CRU driver Sensor I2C driver (IMX415)	V4L2 device driver (Arm offering)
2-2		3A software binary	AE / AWB / AF	Arm offering AF (Auto Focus) not verified
2-3		Arm's tool	Calibration tool Control tool	Arm offering
2-4		Sample application	1. Monitoring and output to the display 2. Encodes data input from the ISP and controls it in conjunction with DRP-AI	—

ISP SUPPORT PACKAGE SUPPORTED OPERATING MODES

No. of IMX415s	Operation Mode		Frame Rate (fps)	RZ/V2H	RZ/V2N		Note
				Ver.1.20	Ver.1.01 *	Ver.1.10s **	
1 (Single)	4K (All Pixel)	Normal	30	✓	✓	✓	
		DOL	30	✓	✓	✓	
		HDR	15	✓	-	✓	
	F-HD (2x2 Binning)	Normal	60	✓	✓	✓	
		DOL	60	✓	-	✓	
		HDR	30	✓	-	✓	
2 (Dual)	4K (All Pixel)	Normal	30 x 2	✓	-	-	
		DOL	15 x 2	✓	-	-	
		HDR	15 x 2	✓	-	-	
	F-HD (2x2 Binning)	Normal	60 x 2	✓	✓	✓	
		DOL	30 x 2	✓	-	✓	
		HDR	30 x 2	✓	-	✓	

*: For AI SDK v5.00 **: For AI SDK v6.00

Note: Please note that Dual Sensor, DOL, HDR and 3D-NR increase bus bandwidth.

SENSOR SETTINGS & TWO SENSORS SYNCHRONIZED CONNECTION

ISP support package is based on the sensor setting detailed in the table below

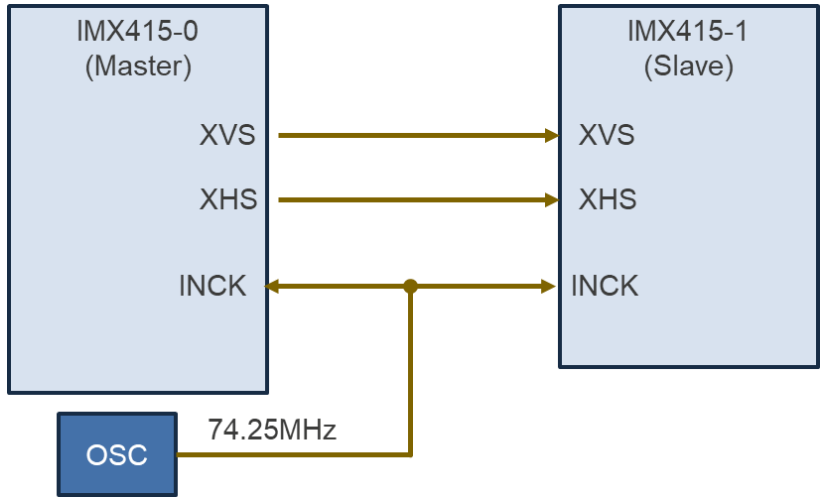
Mode	Lane	Data rate [Mbps/Lane]	Output Bit width	INCK [MHz]
4K (All pixel)	4	891	12	74.25
F-HD (Binning)				
4K (All pixel DOL)		1782		

For sensor synchronization when connecting two sensors, refer to the following.

- Sensor 0 is Master, and sensor 1 should be operated with Slave. Connect Master's XVS and XHS to Slave's XVS and XHS. Please connect the same INCK as one.
- For details, please refer to the circuit diagram included in the ISP support Package. In addition, please refer to sensor's data sheets and application notes as well.

  *When connected sensor is single, set it to master operation.

Example of connection at the time of 2 sensors



SUPPORTED FUNCTIONS OF ISP SUPPORT PACKAGE FOR RZ/V2H:V1.20, RZ/V2N:V1.10S

Function	Note
Defect pixel correction	
Black level correction	
Data aggregation for AE/ AWB/ AF	
AE (**A**uto **E**xposure), **AWB** (**A**uto **W**hite **B**alance)	They are provided in Binary. They can be replaced with your algorithm.
2D noise reduction (Sinter) 3D noise reduction*(Temper)	3D-NR is default OFF setting. Please use it after careful evaluation because memory bus bandwidth is increased.
Demosaic	RGGB Bayer only
Flicker correction	Default OFF setting
Tone mapping settings	
Wide Dynamic Range correction (2 DOL screens / 2 HDR screens* / 1 Iridix screen)	DOL and HDR increase the memory bus bandwidth. Please use it after careful evaluation. DOL and HDR are output from the sensor in virtual channels (VC).
Chromatic aberration correction	
Purple fringing correction	
Shading correction	Default setting does not include correction values
Sharpness correction	
Resize (downscaling)	
RAW image acquisition	It can be used with the calibration tool.

LIMITATIONS OF ISP SUPPORT PACKAGE FOR RZ/V2H:V1.20, RZ/V2N:V1.10S

No.	Limitations	Note
1	More than 3 sensors are not supported	Please customize by referring to the ISP support package (sample code)
2	It is based on the CMOS sensor IMX415	If a sensor other than the IMX415 is used, customization by the customers themselves is required. When changing to another sensor, refer to Section 6 of the ISP support package User's Manual. Supported sizes are up to 4096x2176 @ 60fps (for RZ/V2H). Please check UM for details.
3	When connecting two sensors, connect the same CMOS sensor with the same drive.	Support different sensors combination in future version updates.
4	Lens shading correction is supported, but the correction value is not included	Set the parameters according to the lens used by the customers
5	The difference in color between camera 1 and camera 2	Refer to page 19. This is not the issue of ISP, but it is greatly affected by subject and lens shading.
6	When shooting an LCD screen, magenta may appear	This occurs when the difference between the surrounding color temperature and the color temperature of the liquid crystal is large, and the proportion of the liquid crystal on the screen is small. (No countermeasures)

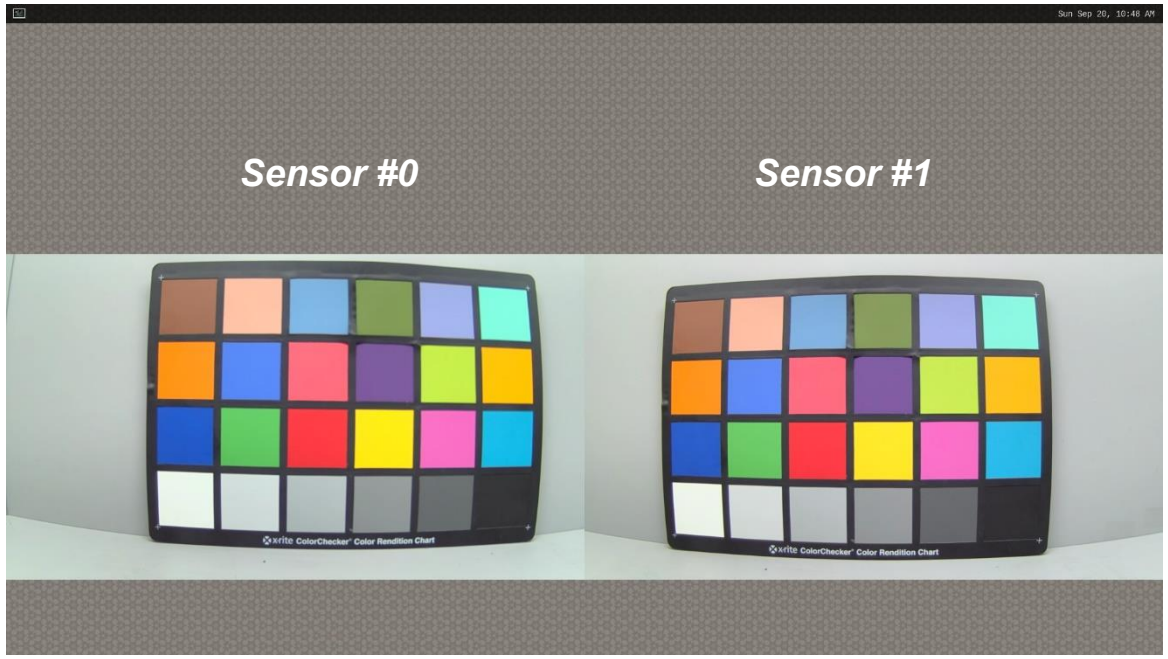
LIMITATIONS OF ISP SUPPORT PACKAGE FOR RZ/V2H:V1.20, RZ/V2N:V1.10S

No.	Limitations	Note
7	Flicker correction is compatible with 50Hz/60Hz fluorescent lamp environments. High-speed blinking of LEDs, etc., cannot be removed by the flicker correction function.	Flicker correction is default OFF setting. Please turn it on by yourself. The oscillation frequency of the LED is not specified, so it cannot be automatically corrected. In order to prevent this, please take measures such as using a CMOS sensor of the global shutter and using manual exposure in the case of a fixed light source environment.
8	There are some functions that cannot be supported by GStreamer provided.	Renesas will continue to make improvements, but we ask customers to make corrections.
9	When using the ISP, you may not be able to use all the functions of the RZ/V2H.	Depending on the customer's use case, the bandwidth constraints of the bus may affect the functionality and performance. Please use it with full evaluation.

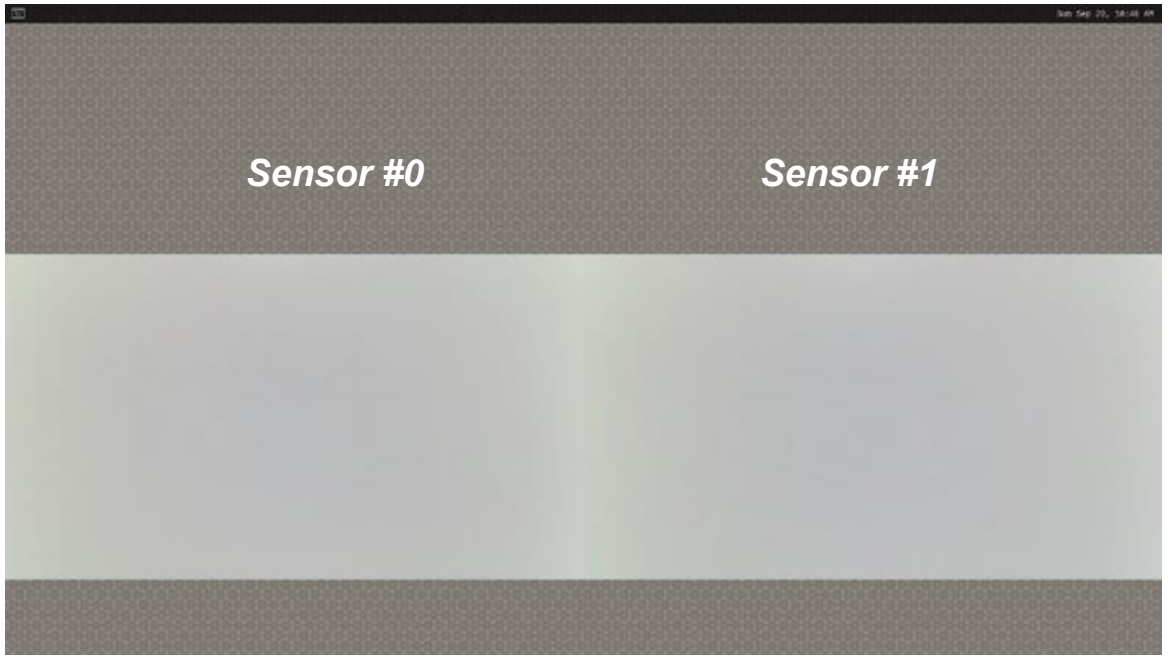
NO5: THE DIFFERENCE IN COLOR BETWEEN CAMERA 1 AND CAMERA 2

There may be the difference in color between two sensors. This is not a defect of ISP.

Picture 1



Picture 2



The reason for the difference in color between the left and right sides in Picture 1 is that there is a difference in the WB convergence value due to the difference in lens shading and angle of view.
Picture 2 converges to the same value because there is no effect on the subject.

REVISION HISTORY

Rev.	Date	Description	
		Page	Summary
1.0	June 12, 2025	-	First edition issued.
1.01	July 11. 2025	8	The link of a download request, modified
		9	The link of Image Quality Tuning Guide, added
		13	For documents list, Image Quality Tuning Guide is added
		14	The specification of RZ/V2N ISP support package ver.1.10s, added