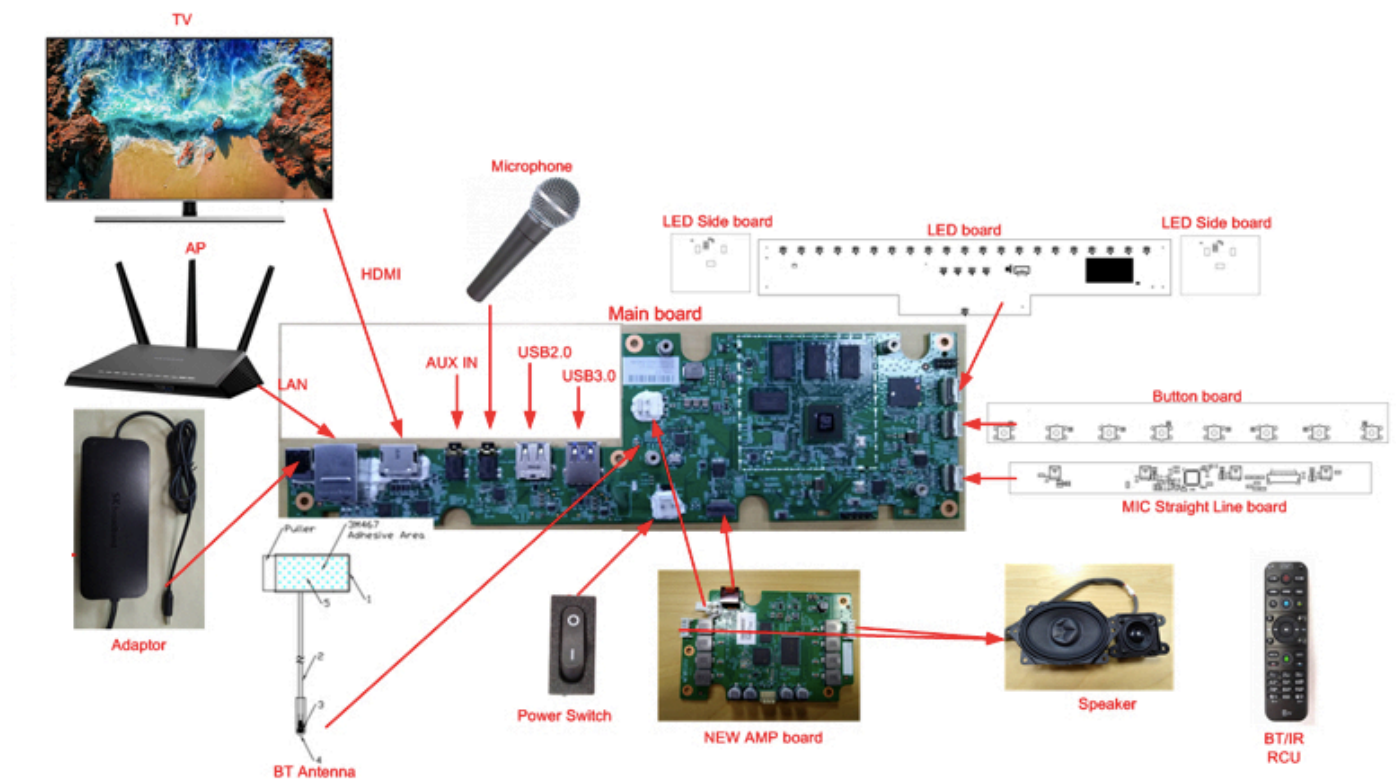


Hardware Unit Test Report

LED Test

Hardware version	FW version	Sample No.	eMMC Flash P/N
V065	19.532.17	MAC: A8:93:4A:FE:95:D4	DDR: 1. K4A8G165WC-BCTD 2. K4A4G165WF-BCTD eMMC: KLM8G1GETF-B041

1. Test Setup



Test setup architecture

2. Test equipment

1. BFX-UA300 EVT board V065, AMP board V135, LED/LED side board/MIC board/Button board V065
2. TV: 4K TV: ENVISION P2271WHL
3. AC Source: APG-1005N: 220Vac @60Hz
4. AC Adaptor: ANY2405D-NIM: AC:220Vac @60Hz; DC: 24V/4A
5. Power meter with accumulator: Yokogawa WT210
6. AP D-Link 10/100
7. Oscilloscope: Tektronix TDS5032B
8. DMM
9. E-loader: Chroma 6312(replace USB HDD)
10. Current probe: TCPA300

3. Test environment

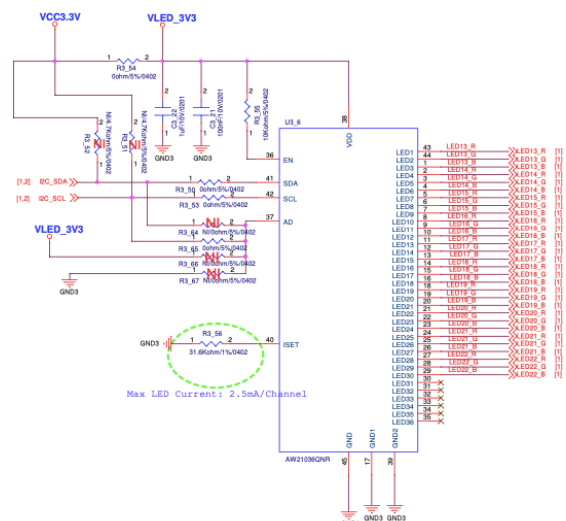
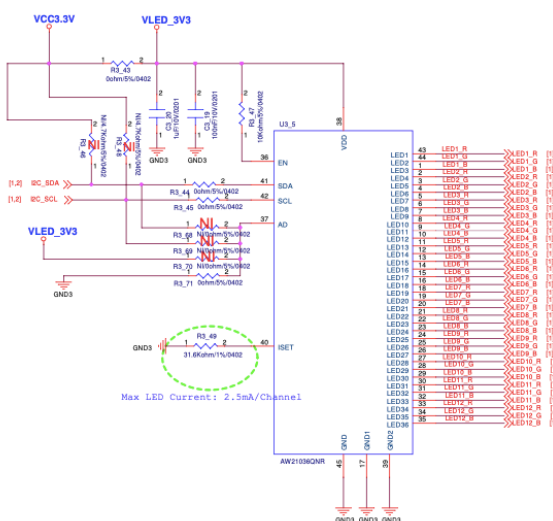
1. Test place: FXN CNSBG Building 1F office
2. Test DUT name: BFX-UA300 EVT main board V135 and LED/LED side board V065
3. Test environment condition: temperature: 25 deg-C, humidity: 65
4. Test date: 2022/1/18
5. Aging test date: 2022/2/22
6. Test result: See section 5 for test results. Aging test results are in section 6.
7. Test setup picture (Power architecture block and reality environment picture)

Criteria:

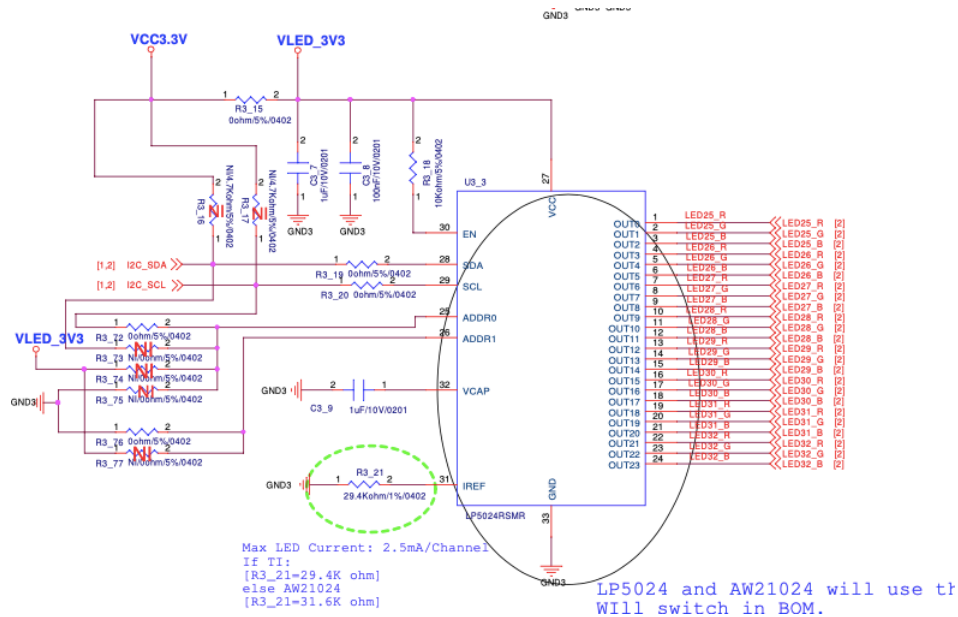
No any LED color different and abnormal brightness.

4. LED board schematic

4.1 Schematic



AW21036QNR LED driver schematic-LED light bar and Status LED



AW21024 LED driver schematic-Side LED and Google LED

```

AW21036
IIC address setup
AD pin
-----|-----
GND      | 01101 00 0/1  [34h(Using), pipe 1-12]
VDD      | 01101 01 0/1  35h
SCL       | 01101 10 0/1  [36h(Using), pipe 13-21, Status]
SDA       | 01101 11 0/1  [37h(Using), Google, L/R side]
Broadcast: 0X1C
  
```

```

AW21024
IIC address setup
ADDR0    | ADDR1
-----|-----
GND      | GND  -->011 0000 0/1 30h
GND      | VDD  -->011 0001 0/1 31h
SCL       | GND  -->011 0010 0/1 [38h(Using), Google L/R side]
SCL       | VDD  -->011 1001 0/1 39h
SDA       | GND  -->011 0011 0/1 3ch
SDA       | VDD  -->011 0011 0/1 3dh
Broadcast: 0X1C
  
```

CURRENT SETTING

The average output current of LED_n (n=1, 2, ..., 24) can be expressed by the following formula,

$$I_{OUT(n)} = \frac{K}{R_{EXT}} \times \frac{GCC}{255} \times \frac{WB}{255} \times \frac{COL_n}{255} \times \frac{BR_n}{256} \quad n=1, 2, 3, \dots, 24$$

Where $K=80V$, R_{EXT} is the value of external resistor, GCC is the 8bit global current configured by the register GCCR (address 6Eh), WB is 8bit white balance parameter configured by the register WBR/WBG/WBB (address 90h/91h/92h), COL_n is 8bit individual constant current parameter, and BR_n is 8bit individual PWM modulated current parameter.

Note: GCC register is set at 0xF0 for maximum current for 2.5mA.

4.2 Test command example

Parameter setup: color

Echo 0x123456

Where:

0x12_ _ _ _ is Red LED bright and color

0x_ _34_ _ is Green LED bright and color

0x_ _ _ _56 is Blue LED bright and color

Red-LED

```
echo 0x120000 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led0/color
```

Green-LED

```
echo 0x003400 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led0/color
```

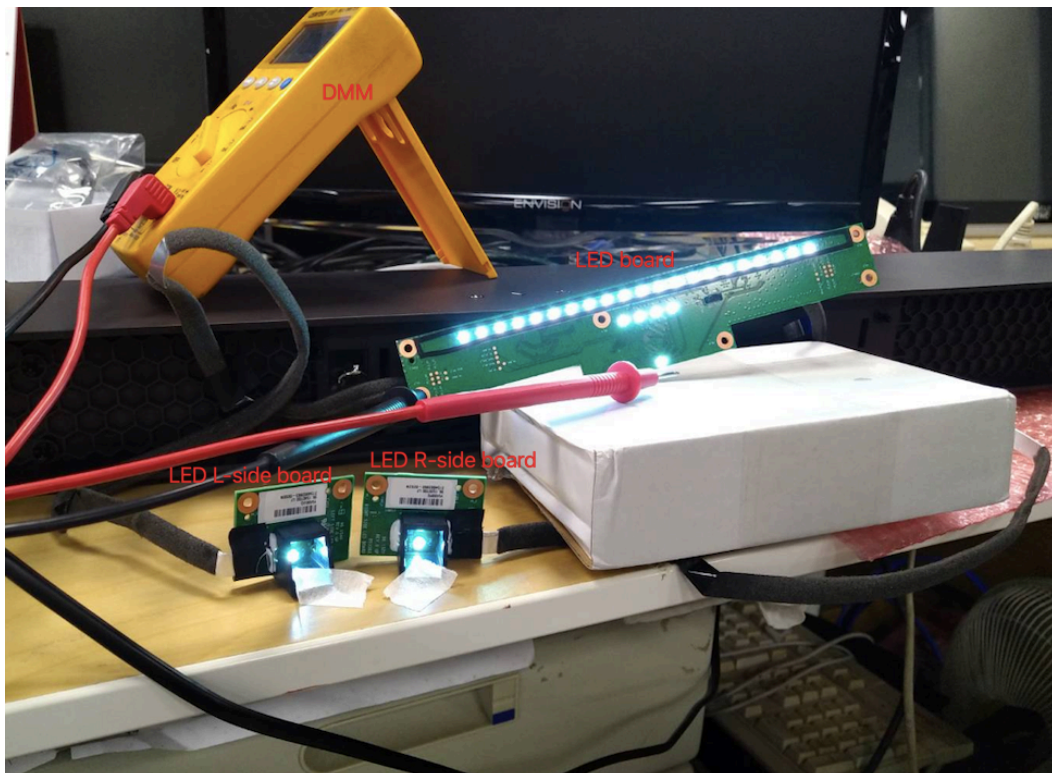
Blue-LED

```
echo 0x000056 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led0/color
```

Parameter setup: color

echo 255: means 00~255 levels for LED driving current.

```
echo 255> /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led0/brightness
```



U3_5 command: AW21036

Color:

```
echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led0/color
echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led1/color
echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led2/color
echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led3/color
echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led4/color
echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led5/color
echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led6/color
echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led7/color
echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led8/color
echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led9/color
echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led10/color
echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led11/color
```

Brightness:

```
echo 255> /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led0/brightness
echo 255> /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led1/brightness
echo 255> /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led2/brightness
echo 255> /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led3/brightness
echo 255> /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led4/brightness
echo 255> /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-0034/leds/aw21036_led:row1_led5/brightness
echo 255> /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
```

0034/leds/aw21036_led:row1_led6/brightness

echo 255> /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0034/leds/aw21036_led:row1_led7/brightness

echo 255> /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0034/leds/aw21036_led:row1_led8/brightness

echo 255> /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0034/leds/aw21036_led:row1_led9/brightness

echo 255> /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0034/leds/aw21036_led:row1_led10/brightness

echo 255> /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0034/leds/aw21036_led:row1_led11/brightness

U3_6 command: AW21036

Color:

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
0036/leds/aw21036_led:row1_led12/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
0036/leds/aw21036_led:row1_led13/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
0036/leds/aw21036_led:row1_led14/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
0036/leds/aw21036_led:row1_led15/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
0036/leds/aw21036_led:row1_led16/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
0036/leds/aw21036_led:row1_led17/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
0036/leds/aw21036_led:row1_led18/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
0036/leds/aw21036_led:row1_led19/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
0036/leds/aw21036_led:row1_led20/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
0036/leds/aw21036_led:row3_led0/color

Brightness:

echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
0036/leds/aw21036_led:row1_led12/brightness

echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
0036/leds/aw21036_led:row1_led13/brightness

echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0036/leds/aw21036_led:row1_led14/brightness

echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0036/leds/aw21036_led:row1_led15/brightness

echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0036/leds/aw21036_led:row1_led16/brightness

echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0036/leds/aw21036_led:row1_led17/brightness

echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0036/leds/aw21036_led:row1_led18/brightness

echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0036/leds/aw21036_led:row1_led19/brightness

echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0036/leds/aw21036_led:row1_led20/brightness

echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0036/leds/aw21036_led:row3_led0/brightness

U3_3 command: AW21024

Color:

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0038/leds/aw21024_led:row2_led0/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0038/leds/aw21024_led:row2_led1/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0038/leds/aw21024_led:row2_led2/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0038/leds/aw21024_led:row2_led3/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0038/leds/aw21024_led:left_led0/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0038/leds/aw21024_led:left_led1/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0038/leds/aw21024_led:right_led0/color

echo 0xffffffff > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0038/leds/aw21024_led:right_led1/color

Brightness:

echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0038/leds/aw21024_led:row2_led0/brightness

echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

0038/leds/aw21024_led:row2_led1/brightness

echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-

```
0038/leds/aw21024_led:row2_led2/brightness
```

```
echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
```

```
0038/leds/aw21024_led:row2_led3/brightness
```

```
echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
```

```
0038/leds/aw21024_led:left_led0/brightness
```

```
echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
```

```
0038/leds/aw21024_led:left_led1/brightness
```

```
echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
```

```
0038/leds/aw21024_led:right_led0/brightness
```

```
echo 255 > /sys/devices/platform/soc/soc:apb@e80000/f7e81400.i2c/i2c-0/0-
```

```
0038/leds/aw21024_led:right_led1/brightness
```

5. Function Test Result

5.1 Result

The measurement of LED current and voltage is on U3_3/U3_5/U3_6 LED driver for verified if any voltage drop and record LED current record. U3_5/U3_6 are AW21036(for light bar and status LED), and U3_3 is AW21024(Google LED and Side LED). The measurement includes brightness and color tuning by command through I2C, see as table 1 which is brightest as command 0xffffffff for RGB LED.

Table1. LED measurement

Location	Driver	LED NO.	RGB	Voltage(V)		Current(mA)
				Anode	Cathode	Cathode
LED board	U3_5 AW21036QNR	D1	R	4.96	3.15	2.51
			G	4.98	2.24	2.53
			B	4.98	2.13	2.57
		D2	R	4.98	3.14	NA
			G	4.98	2.31	NA
			B	4.98	2.1	NA
		D3	R	4.98	3.14	NA
			G	4.98	2.26	NA
			B	4.98	2.12	NA
		D4	R	4.98	3.14	NA
			G	4.98	2.24	NA
			B	4.98	2.12	NA
		D5	R	4.98	3.15	NA
			G	4.98	2.24	NA
			B	4.98	2.13	NA
		D6	R	4.98	3.14	NA
			G	4.98	2.38	NA

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				B	4.98	2.12	NA
			D7	R	4.98	3.14	NA
				G	4.98	2.2	NA
				B	4.98	2.15	NA
			D8	R	4.98	3.14	NA
				G	4.98	2.28	NA
				B	4.98	2.1	NA
			D9	R	4.98	3.14	NA
				G	4.98	2.22	NA
				B	4.98	2.17	NA
			D10	R	4.98	3.14	NA
				G	4.98	2.27	NA
				B	4.98	2.16	NA
			D11	R	4.98	3.15	2.52
				G	4.98	2.31	2.53
				B	4.98	2.17	2.56
			D12	R	4.98	3.14	NA
				G	4.98	2.22	NA
				B	4.98	2.17	NA
	U3_6 AW21036QNR		D13	R	4.98	3.14	2.53
				G	4.98	2.32	2.51
				B	4.98	2.16	2.57
			D14	R	4.98	3.14	NA
				G	4.98	2.27	NA
				B	4.98	2.11	NA
			D15	R	4.98	3.14	NA
				G	4.98	2.22	NA
				B	4.98	2.15	NA
			D16	R	4.98	3.14	NA
				G	4.98	2.22	NA
				B	4.98	2.15	NA
			D17	R	4.98	3.14	NA
				G	4.98	2.23	NA
				B	4.98	2.17	NA
			D18	R	4.98	3.14	NA
				G	4.98	2.22	NA
				B	4.98	2.15	NA
			D19	R	4.98	3.14	NA
				G	4.98	2.22	NA
				B	4.98	2.14	NA

LED side board			D20	R	4.98	3.15	NA
				G	4.98	2.15	NA
				B	4.98	2.15	NA
			D21	R	4.98	3.14	2.58
				G	4.98	2.14	2.45
				B	4.98	2.17	2.56
			D22	R	4.98	3.14	NA
				G	4.98	2.28	NA
				B	4.98	2.12	NA
	U3_3 AW21024		D29	R	4.98	3.14	2.5
				G	4.98	2.25	2.5
				B	4.98	2.13	2.57
			D30	R	4.98	3.15	NA
				G	4.98	2.2	NA
				B	4.98	2.15	NA
			D31	R	4.98	3.14	NA
				G	4.98	2.28	NA
				B	4.98	2.15	NA
			D32	R	4.98	3.14	NA
				G	4.98	2.31	NA
				B	4.98	2.17	NA
			D4_1	R	4.94	3.13	2.5
				G	4.94	2.28	2.5
				B	4.94	2.1	2.57
			D4_2	R	4.94	3.14	NA
				G	4.94	2.27	NA
				B	4.94	2.1	NA
			D5_1	R	4.94	3.13	2.5
				G	4.94	2.28	2.49
				B	4.94	2.15	2.56
			D5_2	R	4.94	3.14	NA
				G	4.94	2.27	NA
				B	4.94	2.15	NA

Note: The 0 ohm at LED RGB cathode side is for easy to measure the LED current. But only D1/D11/D13/D21/D29 and LED side board D4_1/D5_1 has 0 ohm for measurement current, so there is only 6 LEDs have current value.

6. AWINIC LED driver IC aging test

As the requirement of LED driver IC aging test condition, LED color change per second and lasted for 72 hrs. There are 13 colors for Nugu, status indicator and Side LED.

The colors are as below:

Nugu: Blue, Green, Orange

Status: Blue, Green, Red, White

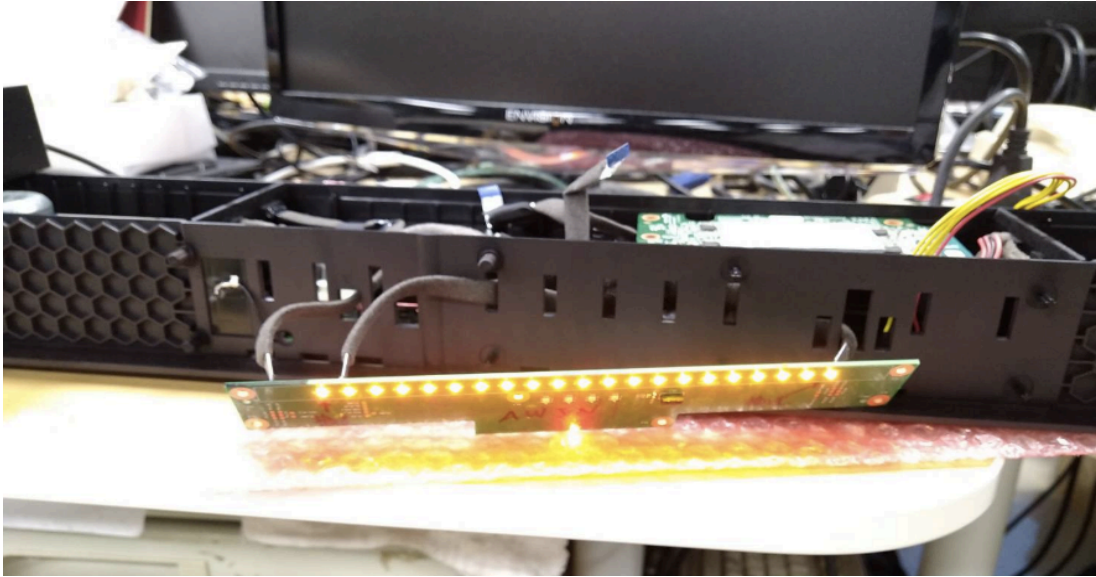
Side: Cyan, Orange, Pink, White(It uses 2 different colors), yellow.

All the LED brightness is 255.

designed color	LED color table:					
	Brightness= 255(FF)					
	Red		Green		Blue	
	Dec	Hex	Dec	Hex	Dec	Hex
Blue - nugu	0	0	0	0	250	FA
Blue - Status	140	8C	165	A5	255	FF
Cyan - side	70	46	205	CD	255	FF
Green - Nugu	120	78	255	FF	115	73
Green - Status	120	78	255	FF	115	73
Orange - Nugu	255	FF	35	23	0	0
Orange - side	255	FF	60	3C	0	0
Pink - side	255	FF	58	3A	120	78
Red - Status	255	FF	0	0	0	0
White - Side	220	DC	205	CD	110	6E
White - Side	225	E1	235	EB	155	9B
White - Status	220	DC	105	69	80	50
Yellow - side	235	EB	125	7D	0	0

SW team provides the SH file for test and switch Nugu, Status indicator and Side LED colors per second. The LED switching is lasted for 72 hrs. So the measurement needs before and after aging test for current measurement. Due to Saturday and Sunday, LED driver IC is lasted extra for 92 hrs(totally aging time is 6 days and 20 hrs, 164 hrs.).

7.1. Test Environment:



Aging test environment, front LED panel.



Side LED

```
命令提示字元 - adb shell
mugu color 0x0000fa
Status input is 2
Status color 0xff0000
Side input is 0
Side color 0x46cddf
mugu input is 1
mugu color 0x78ff73
Status input is 3
Status color 0xdc6950
Side input is 1
Side color 0xff3c00
mugu input is 2
mugu color 0xff2300
Status input is 0
Status color 0x8ca5ff
Side input is 2
Side color 0xff3a78
mugu input is 0
mugu color 0x0000fa
Status input is 1
Status color 0x78FF73
Side input is 3
Side color 0xdccdd6e
mugu input is 1
mugu color 0x78ff73
Status input is 2
Status color 0xff0000
Side input is 4
Side color 0xe1eb9b
mugu input is 2
mugu color 0xff2300
Status input is 3
Status color 0xdc6950
Side input is 5
Side color 0xeb7400
```

Test command dialogs.

7.2. Test results:

The results seem not different before and after aging test. AWINIC LED driver is stable for LED panel.

Awinic IC before aging test LED color change per 1 second

designed color	Brightness= 255(FF)								
	Red			Green			Blue		
	Dec	Hex	Current(mA)	Dec	Hex	Current(mA)	Dec	Hex	Current(mA)
Blue - nugu	00		0	00		0	250	FA	2.59
Blue - Status	140	8C	1.5	165	A5	1.76	255	FF	2.6
Cyan - side	70	46	0.69	205	CD	2.14	255	FF	2.55
Green - Nugu	120	78	1.24	255	FF	2.68	115	73	1.17
Green - Status	120	78	1.24	255	FF	2.69	115	73	1.16
Orange - Nugu	255	FF	2.67	35	23	0.36	00		0
Orange - side	255	FF	2.53	60	3C	0.62	00		0
Pink - side	255	FF	2.53	58	3A	0.6	120	78	1.22
Red - Status	255	FF	2.68	00		0	00		0
White - Side	220	DC	2.19	205	CD	2.13	110	6E	1.09
White - Side	225	E1	2.24	235	EB	2.44	155	9B	1.56
White - Status	220	DC	2.33	105	69	1.09	80	50	0.8
Yellow - side	235	EB	2.33	125	7D	1.3	00		0

Awinic IC after 164 hr LED color change per 1 second

designed color	Brightness= 255(FF)								
	Red			Green			Blue		
	Dec	Hex	Current(mA)	Dec	Hex	Current(mA)	Dec	Hex	Current(mA)
Blue - nugu	00		0	00		0	250	FA	2.59
Blue - Status	140	8C	1.5	165	A5	1.76	255	FF	2.6
Cyan - side	70	46	0.69	205	CD	2.14	255	FF	2.55
Green - Nugu	120	78	1.24	255	FF	2.68	115	73	1.17
Green - Status	120	78	1.24	255	FF	2.69	115	73	1.16
Orange - Nugu	255	FF	2.68	35	23	0.36	00		0
Orange - side	255	FF	2.53	60	3C	0.62	00		0
Pink - side	255	FF	2.53	58	3A	0.6	120	78	1.19
Red - Status	255	FF	2.68	00		0	00		0
White - Side	220	DC	2.19	205	CD	2.13	110	6E	1.09
White - Side	225	E1	2.24	235	EB	2.44	155	9B	1.56
White - Status	220	DC	2.33	105	69	1.09	80	50	0.8
Yellow - side	235	EB	2.33	125	7D	1.3	00		0

Note: GCC register is set at 0xFC for maximum current for 2.6mA considering flannel transmittance.