

EMC TEST REPORT

Product Name ISS(interactive smart shelf)

Trade mark LG Display

Model No. LD230EKS-FPN1

FCC ID: 2AXECLD230EKS-FPN1

Report No. CTB220715030EX

Applicant LG Display Co., Ltd.

LG TWIN TOWERS (EAST), 128, Yeoui-daero, Yeongdeungpo-gu,
Seoul 07336, Republic of Korea

Manufacturer LG Display Co., Ltd.

LG TWIN TOWERS (EAST), 128, Yeoui-daero, Yeongdeungpo-gu,
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Date of Receipt 2022-06-28

Date of Test(s) 2022-06-28~ 2022-07-15

Date of Issue 2022-07-18

Test Standard(s) CFR47, FCC Part 15 Subpart B, ANSI C63.4: 2014

Test Result: Pass

In the configuration tested, the EUT complied with the standards specified above.

Compiled by:



Zack Zhu

Reviewed by:



Bin Mei

Approved by:



Note: The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report shall not be reproduced except in full, without prior written approval of CTB. This document may be altered or revised by CTB, personnel only, and shall be noted in the revision of the document.

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1. Description of version

Report No.	Issue Date	Description	Approved
CTB220715030EX	2022-07-18	Original	Valid

Note: This product has been tested for electromagnetic compatibility before MOS change (The MOS manufacturer (Diodes) is the same, and the model is changed from DMG3415U to DMP2045U), The original test report was NO.: CTB210430028EX

2. Test summary

Test procedures according to the technical standards:

Standard	Test Item	Test Result
§15.107	Conducted Emission	PASS
§15.109	Radiated Emission	PASS

3. Measurement uncertainty

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard

Test Item	Frequency	Expanded Uncertainty (U_{Lab})
Conducted Emission	150 kHz to 30 MHz	± 3.2 dB
Radiated Emission	30 MHz to 1000 MHz	± 4.8 dB
Radiated Emission	Above 1000 MHz	± 4.9 dB

uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %

4. General information

4.1. Description of EUT

Product name	ISS(interactive smart shelf)
Trade mark	LG Display
Model No.	LD230EKS-FPN1
Serial No.	/
Model Difference	/
Rated Power	36W
Normal Testing Voltage	AC120V/60Hz
Configuration	☒ Table-top ☐ Floor-standing
Adapter Information:	Model No:GQ36-120300-AU Input:AC 100-240V-50/60Hz 1.0A Max Output:DC 12.0V 3.0A 36.0W

Note: The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

4.2. Description of accessory device

No.	Device Type	Brand	Model	Specification	Note
1	AC adaptor	/	GQ36-120300-AU	/	/
2	Monitor	DELL	HA45NM140	/	/
3	HDMI Cable	/	spiron5570	/	//
4	USB flash drive	Kingston	USB25630	/	/
5	Micro USB cable	/	/		

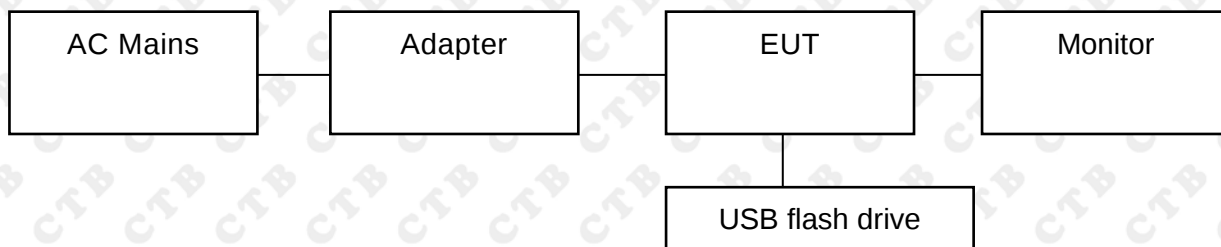
4.3. Test conditions

Temperature: 15-25°C

Relative Humidity: 30-60 %

Atmospheric pressure: 800hPa-1060hPa

4.4. Block diagram of EUT configuration



4.5. Operating condition of EUT

Operating condition	Mode 1	Micro HDMI Output Display+ Micro USB Data Exchange	Test Voltage	AC 120V/60Hz* AC 230V/50Hz
	Mode 2	WIFI Link+ BT Link	Test Voltage	AC 120V/60Hz AC 230V/50Hz
Note: This test covers all possible operating modes of the device, only the worst data are listed in report. The worst data are shown (*), which is the nearest standard limit which were recorded in this report.				

5. List of Test and Measurement Instruments

Conducted Emission Measurement					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	AMN	ROHDE&SCHWARZ	ESH3-Z5	831551852	2022.08.05
2	Pulse limiter	ROHDE&SCHWARZ	ESH3Z2	357881052	2022.08.05
3	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCS30	834115/006	2022.08.05
4	Coaxial cable	ZDECL	Z302S	18091904	2022.08.05
5	AAN	Schwarzbeck	NTFM8158	6114	2022.08.05
6	EZ-EMC	Frad	EMC-con3A1.1	/	/

Radiated Emission Measurement					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120D	1911	2022.08.07
2	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	869	2022.08.07
3	Amplifier	Agilent	8449B	3008A01838	2022.08.05
4	Amplifier	HP	8447E	2945A02747	2022.08.05
5	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESPI7	100362	2022.08.05
6	Coaxial cable	ETS	RFC-SNS-100-NMS-80 NI	/	2022.08.05
7	Coaxial cable	ETS	RFC-SNS-100-NMS-20 NI	/	2022.08.05
8	Coaxial cable	ETS	RFC-SNS-100-SMS-20 NI	/	2022.08.05
9	Coaxial cable	ETS	RFC-NNS-100-NMS-300 NI	/	2022.08.05
10	EZ-EMC	Frad	EMC-con3A1.1	/	/

6. Conducted Emission

6.1.Limit

☐ Except for Class A devices:

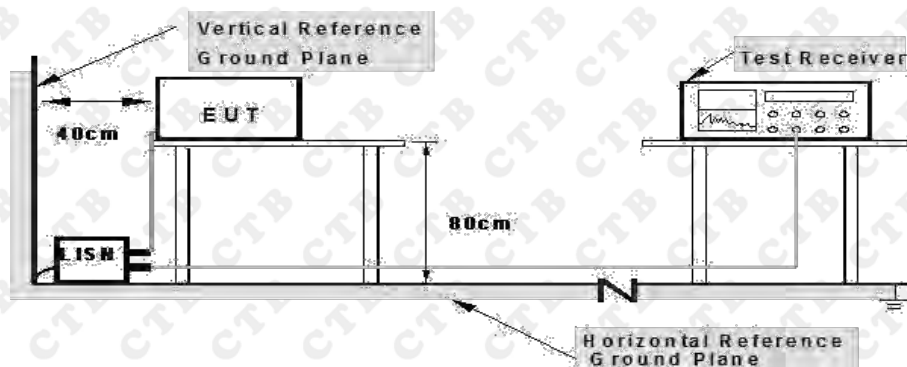
Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

Note: Decreases with the logarithm of the frequency.

☒ For Class A devices:

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	79	66
0.5-30	73	60

6.2.Test setup



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

The setup of EUT is according with ANSI C63.4 measurement procedure. Specification used with FCC Part 15 limits.

6.3.EMI test receiver setup

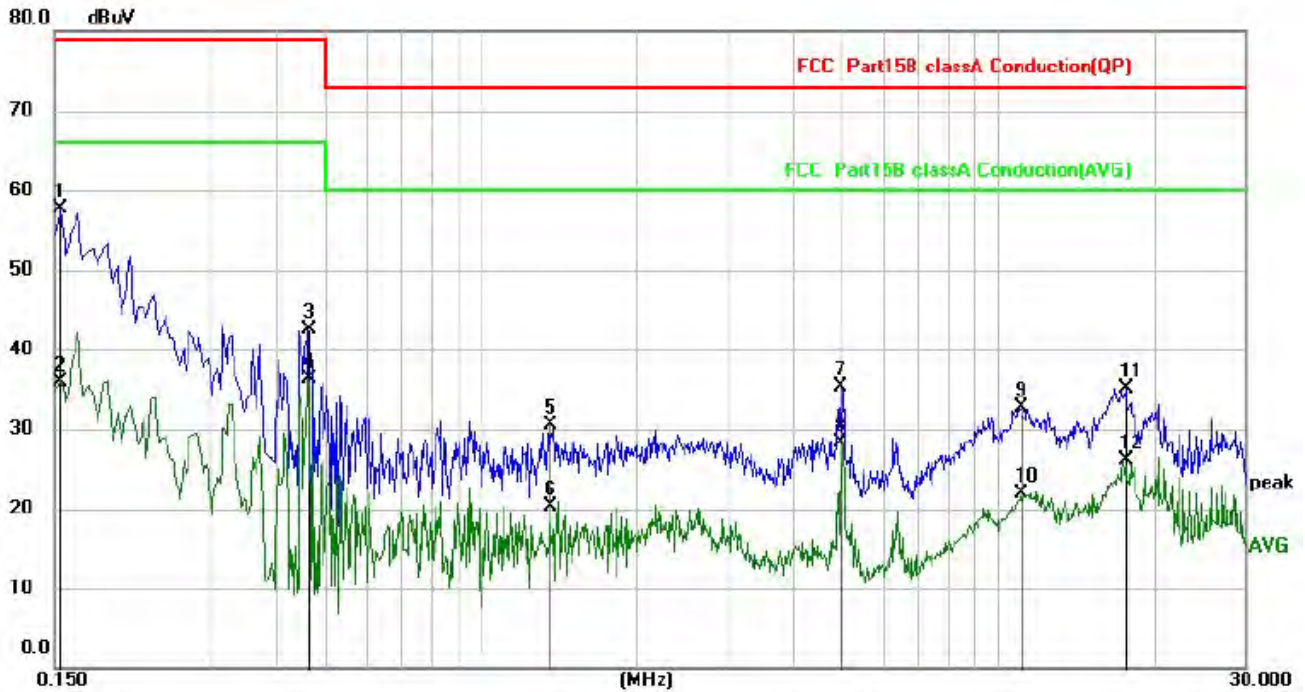
Frequency Range	9kHz-30MHz
Resolution Bandwidth	200Hz (9kHz-150kHz) 9kHz (150kHz-30MHz)

6.4.Test procedure

1. Measurement was performed in shielded room, and instruments used were followed clause 4 of ANSI C63.4.
2. Detailed test procedure was following clause 7 of ANSI C63.4.
3. Frequency range 150kHz – 30MHz was checked and EMI receiver measurement bandwidth was set to 9 kHz.

6.5. Test results

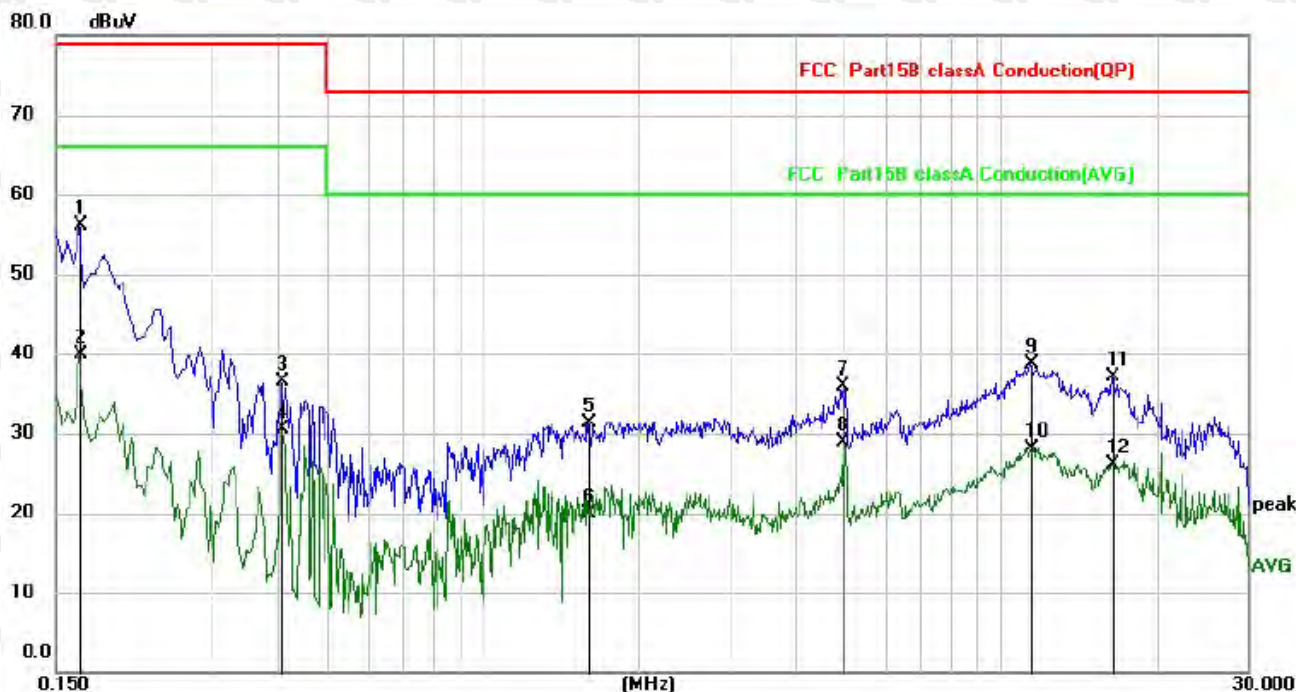
Temperature:	24°C	Relative Humidity:	54 %
Pressure:	101kPa	Phase :	Line
Test Voltage :	AC 120V/60Hz	Test Mode:	Mode 1



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector
1	*	0.1539	47.06	10.72	57.78	79.00	-21.22	QP
2		0.1539	25.19	10.72	35.91	66.00	-30.09	AVG
3		0.4660	31.97	10.54	42.51	79.00	-36.49	QP
4		0.4660	25.79	10.54	36.33	66.00	-29.67	AVG
5		1.3660	19.79	10.62	30.41	73.00	-42.59	QP
6		1.3660	9.75	10.62	20.37	60.00	-39.63	AVG
7		4.9579	24.60	10.65	35.25	73.00	-37.75	QP
8		4.9579	17.62	10.65	28.27	60.00	-31.73	AVG
9		11.1339	21.87	10.84	32.71	73.00	-40.29	QP
10		11.1339	11.01	10.84	21.85	60.00	-38.15	AVG
11		17.6939	24.12	10.95	35.07	73.00	-37.93	QP
12		17.6939	15.12	10.95	26.07	60.00	-33.93	AVG

Note: Result=Reading + Factor
Over Limit=Result - Limit

Temperature:	24°C	Relative Humidity:	54 %
Pressure:	101kPa	Phase :	Neutral
Test Voltage :	AC 120V/60Hz	Test Mode:	Mode 1



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector
1	*	0.1660	45.30	10.71	56.01	79.00	-22.99	QP
2		0.1660	29.23	10.71	39.94	66.00	-26.06	AVG
3		0.4100	25.91	10.57	36.48	79.00	-42.52	QP
4		0.4100	19.85	10.57	30.42	66.00	-35.58	AVG
5		1.5940	20.66	10.62	31.28	73.00	-41.72	QP
6		1.5940	9.33	10.62	19.95	60.00	-40.05	AVG
7		4.9579	25.19	10.65	35.84	73.00	-37.16	QP
8		4.9579	18.30	10.65	28.95	60.00	-31.05	AVG
9		11.4579	27.78	10.84	38.62	73.00	-34.38	QP
10		11.4579	17.34	10.84	28.18	60.00	-31.82	AVG
11		16.4379	26.09	10.93	37.02	73.00	-35.98	QP
12		16.4379	15.18	10.93	26.11	60.00	-33.89	AVG

Note: Result=Reading + Factor
Over Limit=Result – Limit

7. Radiated emissions

7.1.Limit

☐ Except for Class A devices (at 3m):

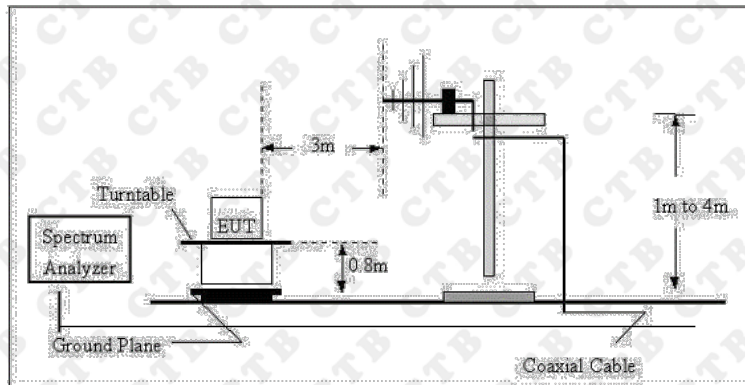
Frequency of emission (MHz)	Field strength (microvolts/meter)	
	(microvolts/meter)	(dB μ V/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

☒ For Class A devices (at 10m):

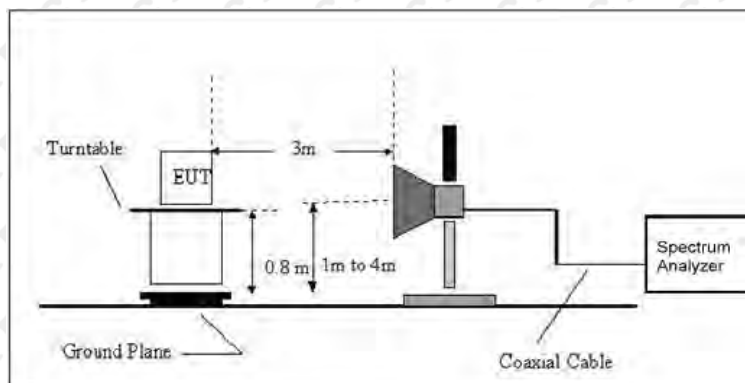
Frequency of emission (MHz)	Field strength (microvolts/meter)	
	(microvolts/meter)	(dB μ V/m)
30-88	90	39
88-216	150	43.5
216-960	210	46.4
Above 960	300	49.5

7.2.Test setup

Radiated Emission Test Set-Up Frequency Below 1 GHz



Radiated Emission Test Set-Up Frequency Above 1GHz



The radiated tests were performed in 3 meter Chamber test site, using the setup accordance with the ANSI C63.4:2014.

7.3.EMI test receiver setup and spectrum analyzer setup

During the radiated emission test, the EMI test receiver and Spectrum Analyzer were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30MHz-1000MHz	100kHz	300kHz	120kHz	QP
Above 1GHz	1MHz	3MHz	/	PK
	1MHz	10Hz	/	AVG

7.4.Test procedure

1. The measurement was performed in a semi-anechoic chamber, and instruments used were followed clause 4 of ANSI C63.4
2. Detailed test procedure was following clause 8 of ANSI C63.4.

7.5.Corrected Amplitude & Margin Calculation

1. The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

2. The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

7.6. Test results

Up to 1GHz:

Temperature:	24°C	Relative Humidity:	54 %
Pressure:	101kPa	Polarization :	Horizontal
Test Voltage :	AC 120V/60Hz	Test Mode:	Mode 1



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		41.4942	33.61	-5.33	28.28	50.00	-21.72	QP
2		78.6888	38.25	-9.52	28.73	50.00	-21.27	QP
3	*	147.9214	45.00	-5.49	39.51	53.50	-13.99	QP
4		239.5670	42.23	-5.80	36.43	56.00	-19.57	QP
5		527.3205	37.71	1.22	38.93	56.00	-17.07	QP
6		742.2587	33.53	4.84	38.37	56.00	-17.63	QP

Note: Result=Reading+Factor
Over Limit=Result-Limit

Temperature:	24°C	Relative Humidity:	54 %
Pressure:	101kPa	Polarization :	Vertical
Test Voltage :	AC 120V/60Hz	Test Mode:	Mode 1



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		39.7146	40.33	-5.34	34.99	50.00	-15.01	QP
2	*	64.8865	42.26	-7.03	35.23	50.00	-14.77	QP
3		147.9214	39.74	-5.49	34.25	53.50	-19.25	QP
4		298.2681	33.20	-5.24	27.96	56.00	-28.04	QP
5		527.3205	35.27	1.22	36.49	56.00	-19.51	QP
6		861.5444	28.35	6.14	34.49	56.00	-21.51	QP

Note: Result=Reading+Factor
Over Limit=Result-Limit

Temperature:	24°C	Relative Humidity:	54 %
Pressure:	101kPa	Polarization :	Horizontal
Test Voltage :	AC 120V/60Hz	Test Mode:	Mode 2



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		59.9639	30.97	-6.17	24.80	50.00	-25.20	QP
2		146.6304	34.13	-5.48	28.65	53.50	-24.85	QP
3		231.3120	37.35	-5.88	31.47	56.00	-24.53	QP
4		446.4141	35.86	-0.57	35.29	56.00	-20.71	QP
5		742.2587	31.79	4.84	36.63	56.00	-19.37	QP
6	*	948.7610	37.04	5.91	42.95	56.00	-13.05	QP

Note: Result=Reading+Factor
Over Limit=Result-Limit

Temperature:	24°C	Relative Humidity:	54 %
Pressure:	101kPa	Polarization :	Vertical
Test Voltage :	AC 120V/60Hz	Test Mode:	Mode 2

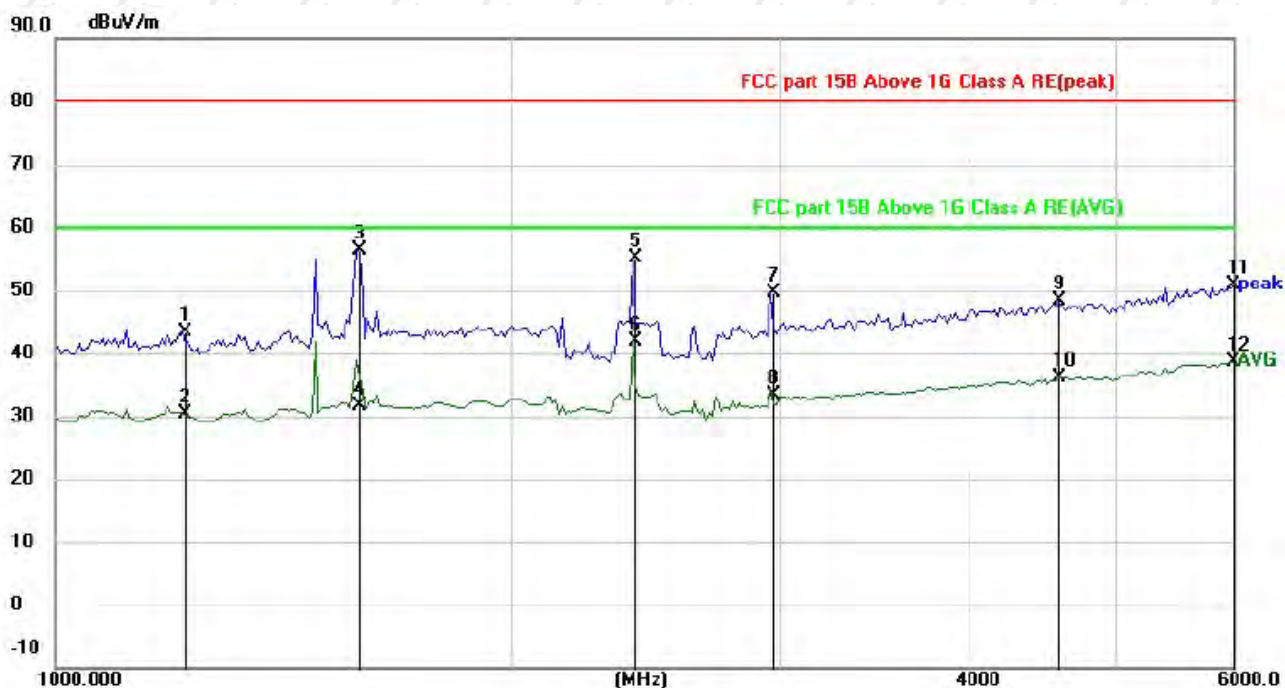


No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	
		MHz	Level	Factor	ment			Detector
			dBuV	dB	dBuV/m	dB/m	dB	
1		40.4172	38.60	-5.29	33.31	50.00	-16.69	QP
2		63.7588	38.51	-6.83	31.68	50.00	-18.32	QP
3		146.6304	32.18	-5.48	26.70	53.50	-26.80	QP
4		231.3120	33.61	-5.88	27.73	56.00	-28.27	QP
5		398.3312	38.03	-1.74	36.29	56.00	-19.71	QP
6	*	948.7610	36.03	5.91	41.94	56.00	-14.06	QP

Note: Result=Reading+Factor
Over Limit=Result-Limit

Above 1GHz:

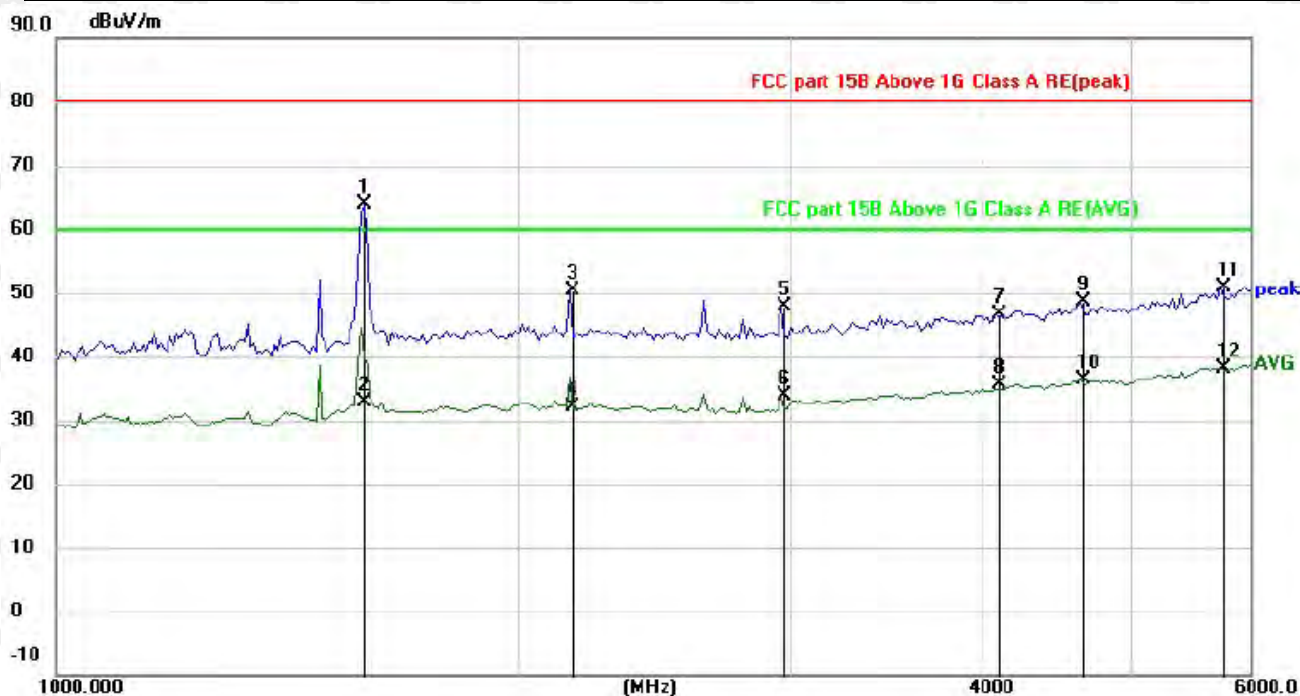
Temperature:	24°C	Relative Humidity:	54 %
Pressure:	101kPa	Polarization :	Horizontal
Test Voltage :	AC 120V/60Hz	Test Mode:	Mode 1



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		1212.415	45.71	-2.41	43.30	80.00	-36.70	peak
2		1212.415	32.84	-2.41	30.43	60.00	-29.57	AVG
3		1579.169	56.51	-0.24	56.27	80.00	-23.73	peak
4		1579.169	31.78	-0.24	31.54	60.00	-28.46	AVG
5		2405.992	52.75	2.37	55.12	80.00	-24.88	peak
6	*	2405.992	39.47	2.37	41.84	60.00	-18.16	AVG
7		2969.798	46.76	2.84	49.60	80.00	-30.40	peak
8		2969.798	30.46	2.84	33.30	60.00	-26.70	AVG
9		4606.530	40.90	7.46	48.36	80.00	-31.64	peak
10		4606.530	28.59	7.46	36.05	60.00	-23.95	AVG
11		6000.000	39.45	11.42	50.87	80.00	-29.13	peak
12		6000.000	27.15	11.42	38.57	60.00	-21.43	AVG

Note: Result=Reading+Factor
Over Limit=Result-Limit

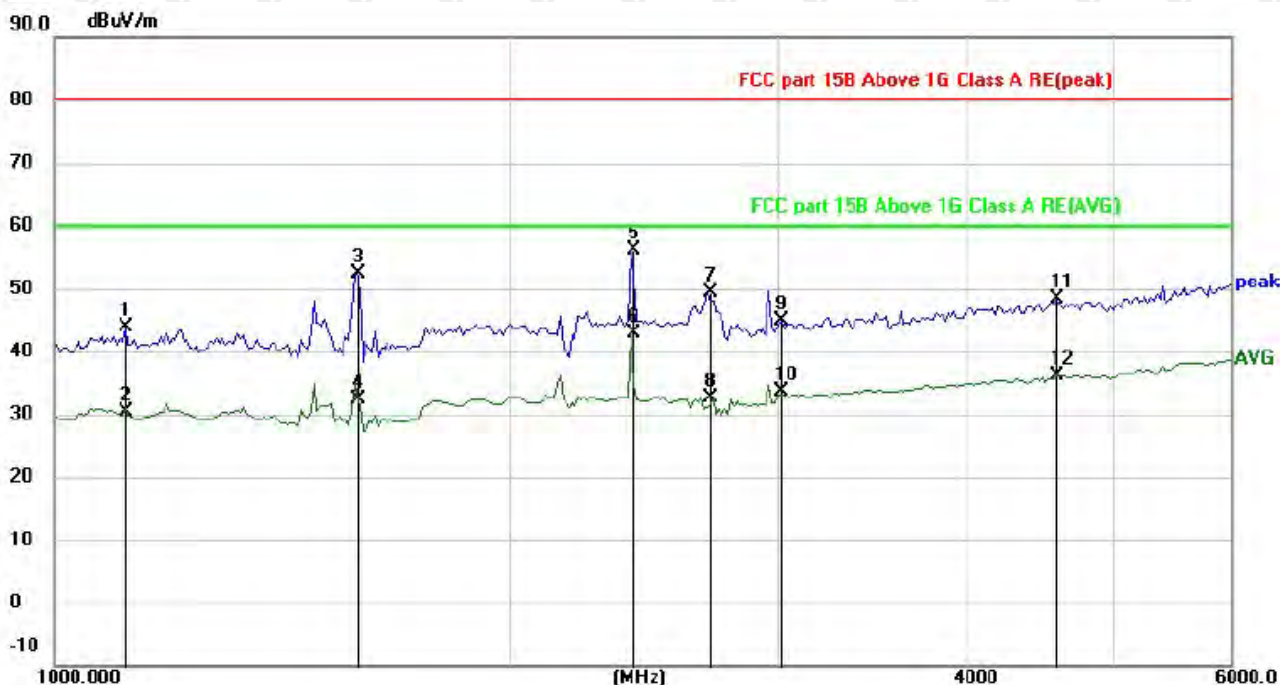
Temperature:	24°C	Relative Humidity:	54 %
Pressure:	101kPa	Polarization :	Vertical
Test Voltage :	AC 120V/60Hz	Test Mode:	Mode 1



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1	*	1586.258	64.17	-0.20	63.97	80.00	-16.03	peak
2		1586.258	33.09	-0.20	32.89	60.00	-27.11	AVG
3		2160.753	48.21	2.17	50.38	80.00	-29.62	peak
4		2160.753	30.03	2.17	32.20	60.00	-27.80	AVG
5		2969.798	45.06	2.84	47.90	80.00	-32.10	peak
6		2969.798	31.13	2.84	33.97	60.00	-26.03	AVG
7		4100.097	40.37	6.32	46.69	80.00	-33.31	peak
8		4100.097	29.19	6.32	35.51	60.00	-24.49	AVG
9		4647.985	40.96	7.55	48.51	80.00	-31.49	peak
10		4647.985	28.93	7.55	36.48	60.00	-23.52	AVG
11		5737.167	40.38	10.61	50.99	80.00	-29.01	peak
12		5737.167	27.56	10.61	38.17	60.00	-21.83	AVG

Note: Result=Reading+Factor
Over Limit=Result-Limit

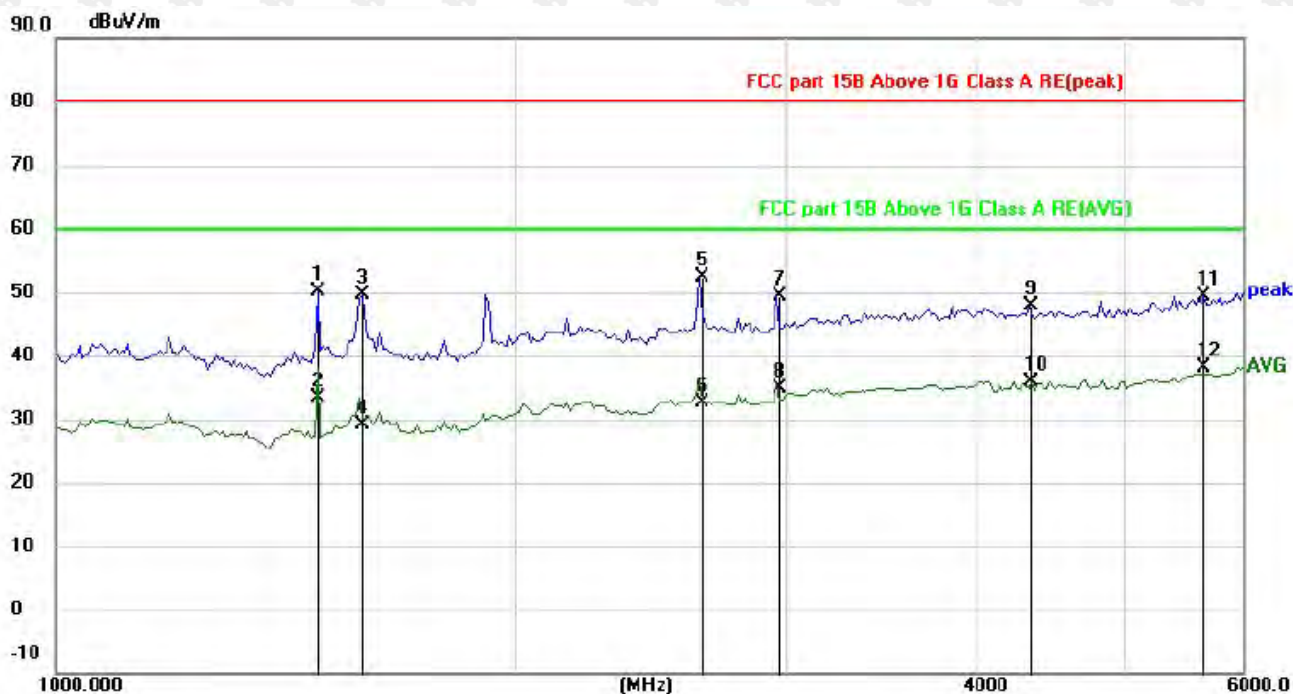
Temperature:	24°C	Relative Humidity:	54 %
Pressure:	101kPa	Polarization :	Horizontal
Test Voltage :	AC 120V/60Hz	Test Mode:	Mode 2



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		1113.497	46.63	-2.86	43.77	80.00	-36.23	peak
2		1113.497	33.27	-2.86	30.41	60.00	-29.59	AVG
3		1579.169	52.51	-0.24	52.27	80.00	-27.73	peak
4		1579.169	32.70	-0.24	32.46	60.00	-27.54	AVG
5		2405.992	53.75	2.37	56.12	80.00	-23.88	peak
6	*	2405.992	40.47	2.37	42.84	60.00	-17.16	AVG
7		2703.174	46.65	2.62	49.27	80.00	-30.73	peak
8		2703.174	30.10	2.62	32.72	60.00	-27.28	AVG
9		3023.489	41.87	2.94	44.81	80.00	-35.19	peak
10		3023.489	30.65	2.94	33.59	60.00	-26.41	AVG
11		4606.530	40.90	7.46	48.36	80.00	-31.64	peak
12		4606.530	28.64	7.46	36.10	60.00	-23.90	AVG

Note: Result=Reading+Factor
Over Limit=Result-Limit

Temperature:	24°C	Relative Humidity:	54 %
Pressure:	101kPa	Polarization :	Vertical
Test Voltage :	AC 120V/60Hz	Test Mode:	Mode 2

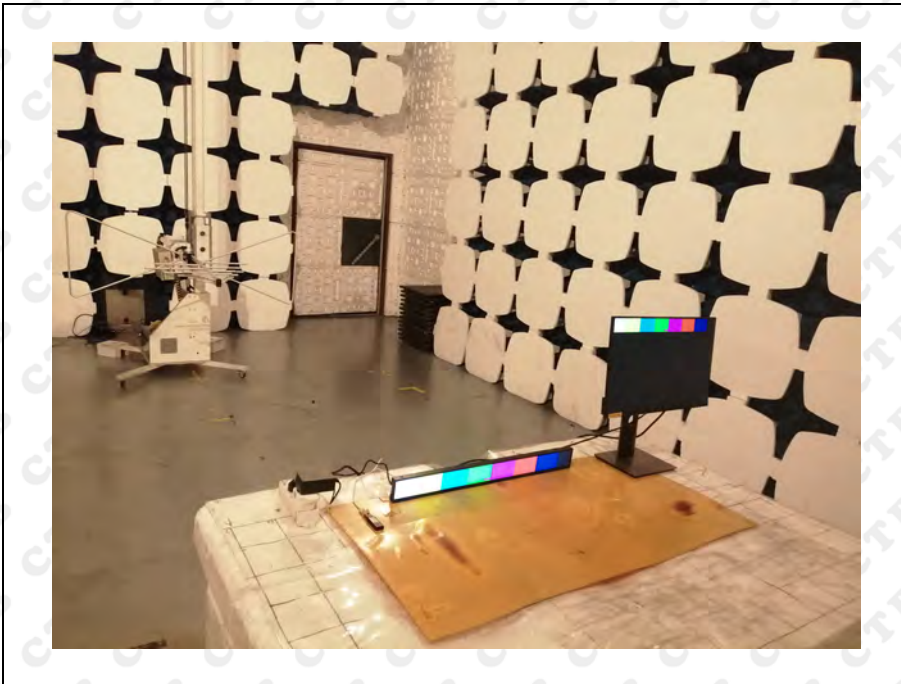


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		1483.178	50.79	-0.76	50.03	80.00	-29.97	peak
2		1483.178	34.02	-0.76	33.26	60.00	-26.74	AVG
3		1586.258	49.71	-0.20	49.51	80.00	-30.49	peak
4		1586.258	29.22	-0.20	29.02	60.00	-30.98	AVG
5		2643.304	49.69	2.57	52.26	80.00	-27.74	peak
6		2643.304	30.10	2.57	32.67	60.00	-27.33	AVG
7		2969.798	46.46	2.84	49.30	80.00	-30.70	peak
8		2969.798	32.05	2.84	34.89	60.00	-25.11	AVG
9		4345.943	41.09	6.87	47.96	80.00	-32.04	peak
10		4345.943	29.07	6.87	35.94	60.00	-24.06	AVG
11		5660.585	39.03	10.37	49.40	80.00	-30.60	peak
12	*	5660.585	27.66	10.37	38.03	60.00	-21.97	AVG

Note: Result=Reading+Factor
Over Limit=Result-Limit

8. Photographs of test setup

Radiated Emission



Radiated Emission Above 1GHz



Conducted Emission

9. Photographs of EUT

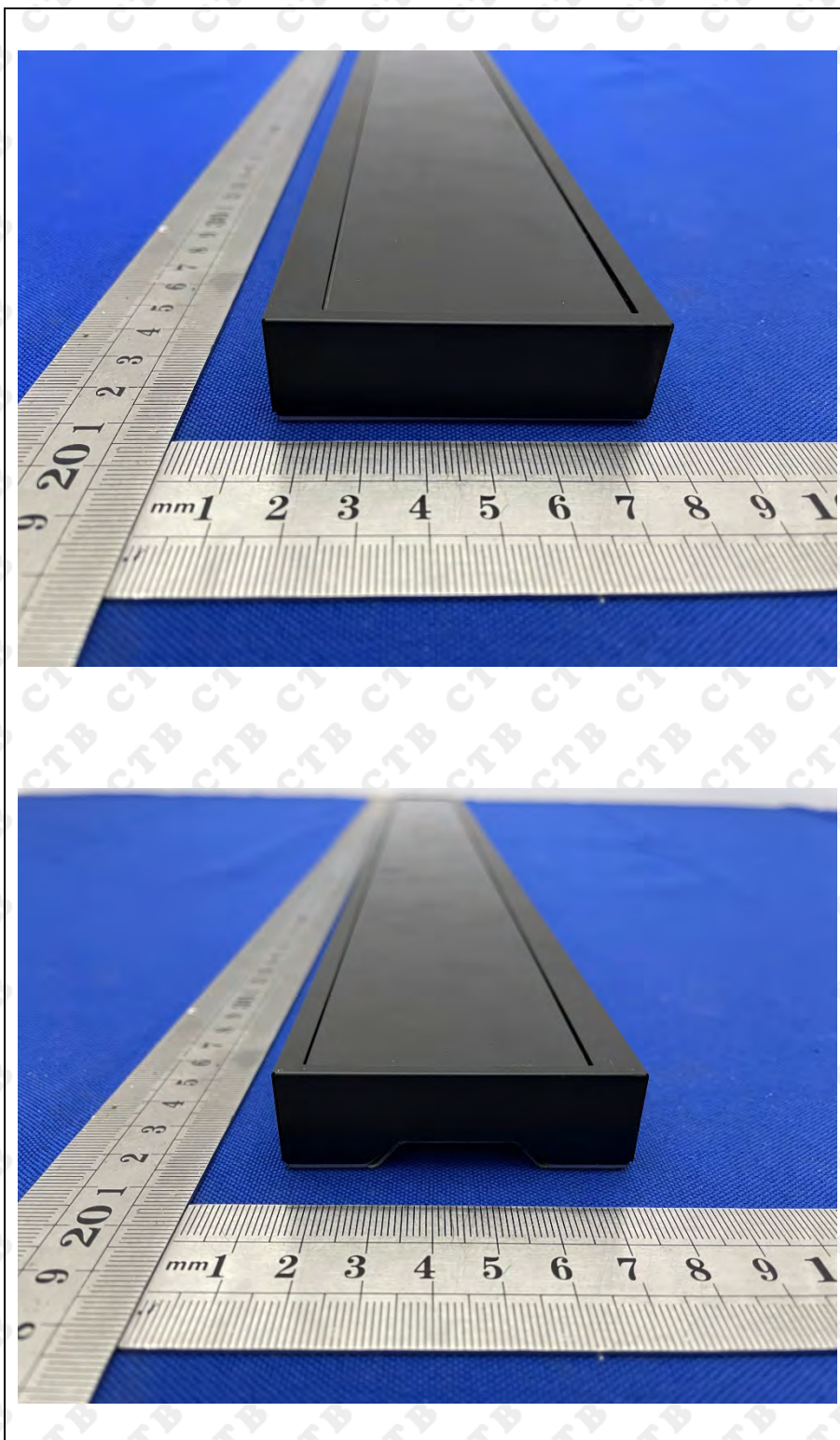
EUT photo 1



EUT photo 2



EUT photo 3



EUT photo 4



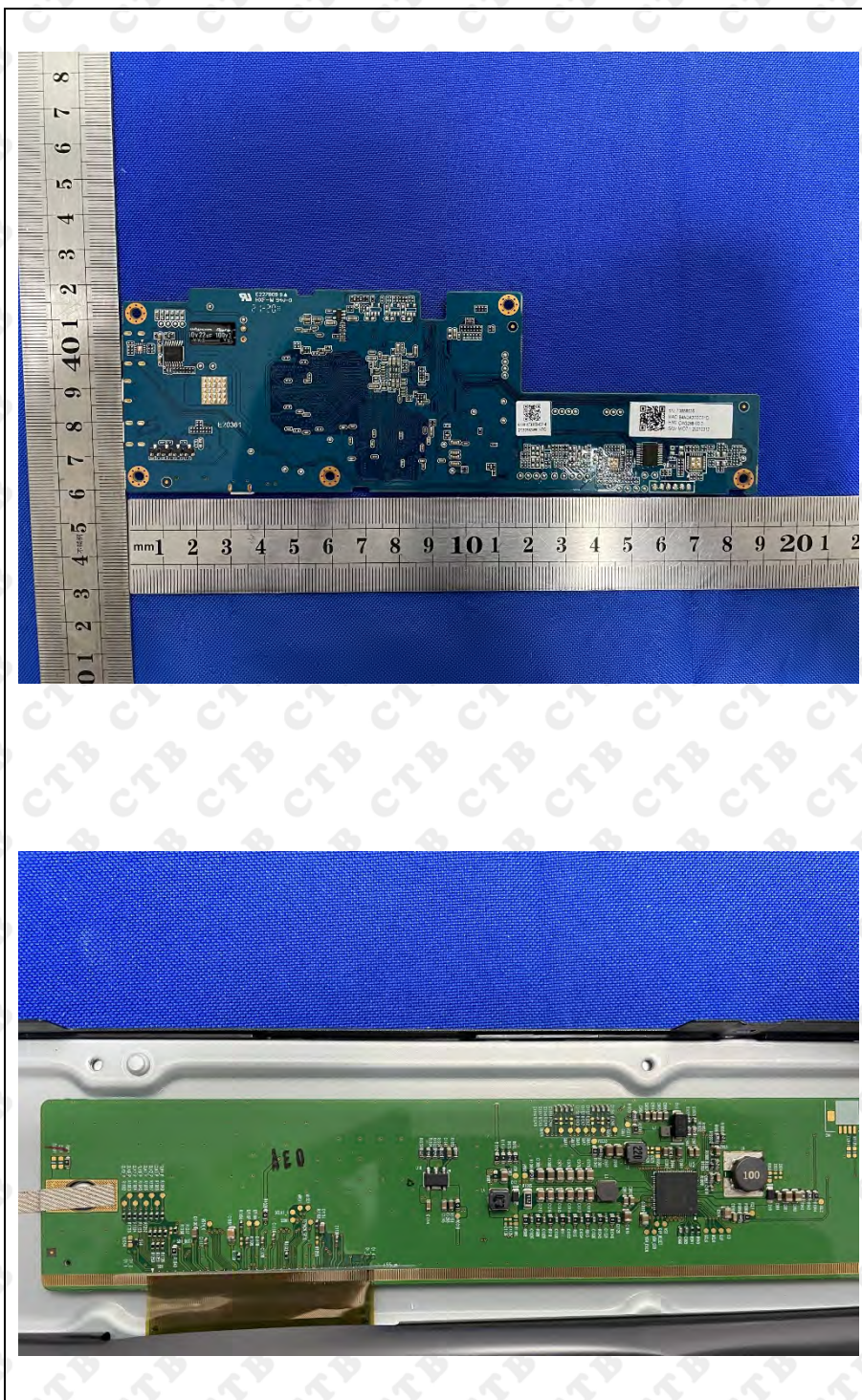
EUT photo 5



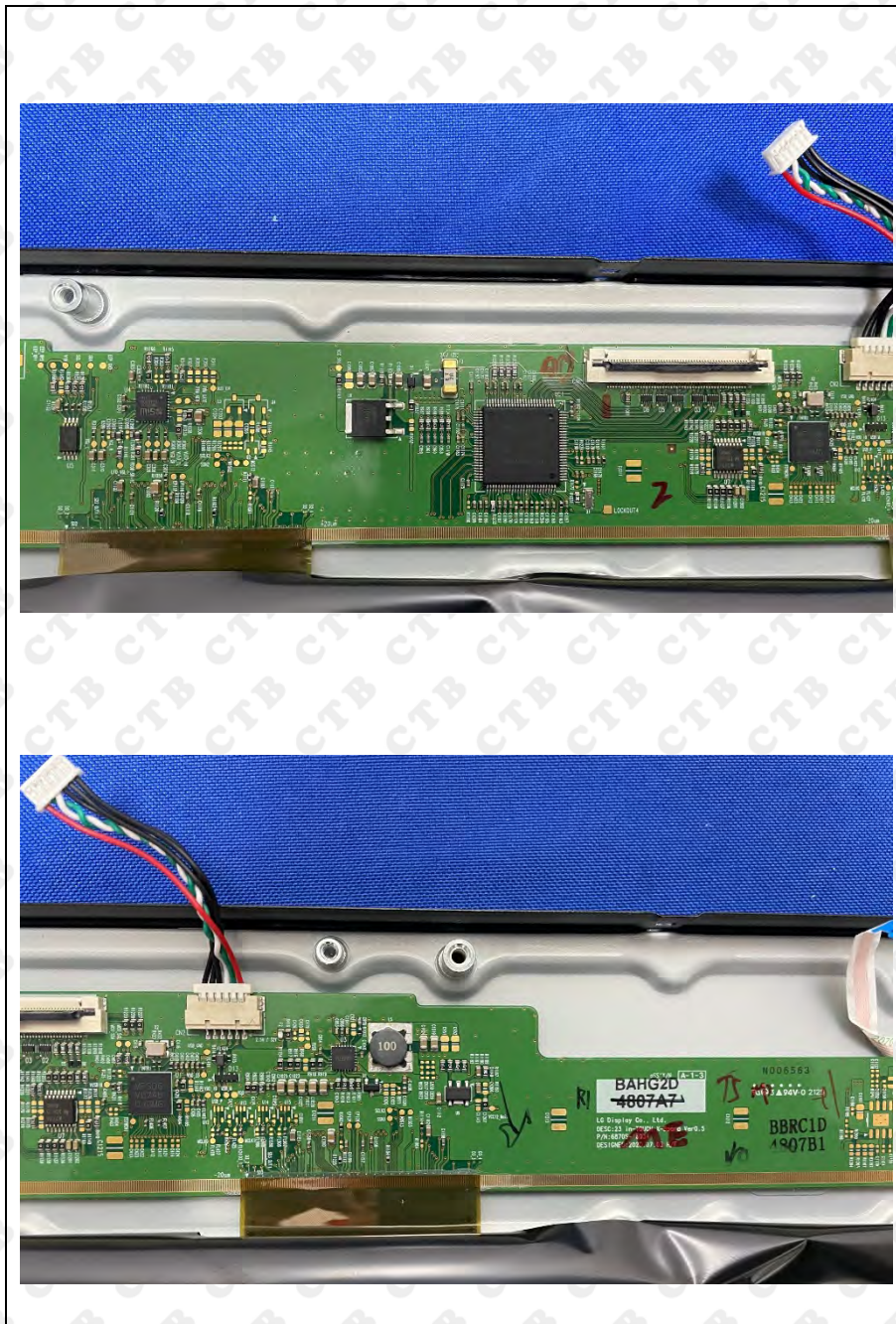
EUT photo 6



EUT photo 7



EUT photo 8



EUT photo 9



End of report