FCC 47 CFR PART 15 Subpart B

TEST REPORT

Equipment	ISS(interactive smart shelf)
Trademark	LG Display
FCC ID:	2AXECLD230EKS-FPN1
Model No.	LD230EKS-FPN1
Report No.	CTB201106021EX
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, Seoul 07336, Republic of Korea
Prepared by	Shenzhen CTB Testing Technology Co., Ltd. Floor 1&2, Building A, No. 26 of Xinhe Road, Xinqiao Street, Baoan District, Shenzhen China Tel: 086-4008-707-283 Fax: 086-0755-23208027
Date of Receipt	Jul. 25, 2020
Date of Test(s)	Jul. 26, 2020 ~ Sep. 4, 2020
Date of Issue	Nov. 6, 2020

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

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

Producer : Amy Yang , Date : Nov. 6, 2020

Amy Yang/Engineer

Signatory : Shen Qian , Date : Nov. 6, 2020

Shen Qian/Chief Director

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.

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
0	Nov. 6, 2020	Initial Issue	All Page	Sherwin Qian

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1. GENERAL INFORMATION

1.1. Description of EUT

Equipment	ISS(interactive smart shelf)
Trade Mark	LG Display
Model Name	LD230EKS-FPN1
Serial No.	Not labeled
Model Difference	N/A
Operating Frequency	AC120V/60Hz
I/O Port	N/A
EUT Power Rating	DC12V from adapter input AC 120V/60Hz
Configuration	☒ Table-top ☐ Floor-standing
Accessory Device	Adapter
Cable Supplied	N/A

Note:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

The EUT uses following Adapter

Adapter	1
Manufacturer	CTL
Model	GQ36-120300-AU
AC Input Power	100-240V, 50/60Hz,1.0A Max
DC Output Power	12V⎓3A
Plug Type	N/A

1. Other Accessory Device List and Details

Description	Manufacturer	Model	Note
-			

External I/O Cable

Cable Description	Shielded Type	Ferrite Core	Length(m)	Note
-	☐Shielded ☐Non-shielded	☐Yes ☐No	-	

2. 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.

2. TEST SUMMARY

Test procedures according to the technical standards:

FCC Rules	Test Item	Test Result
§15.107	Conducted Emission	PASS
§15.109	Radiated Emission	PASS

Remark: N/A is abbreviation for Not Applicable.

The test was carried out in all the test modes, only the worst data are list in report.

3. FACILITIES

3.1. Test Facility

Shenzhen CTB Testing Technology Co., Ltd.
Floor 1&2, Building A, No. 26 of Xinhe Road, Xinqiao Street, Baoan District, Shenzhen China
CNAS Registration Number is L4595.
A2LA Certificate Number is 5599.01.

3.2. Test Instruments

The following list contains measurement equipment used for testing. The equipment conforms to the requirement of CISPR 16-1, ANSI C63.2 and other required standards.

Calibration of all test and measurement, including any accessories that may effect such calibration, is checked frequently to ensure the accuracy. Adjustments are made and correction factors are applied in accordance with the instructions contained in the respective.

Table list of the test and measurement equipment

Conducted Emission Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	AMN	R&S	ESH3-Z5	831551852	2020.10.30
2	Pulse limiter	R&S	ESH3Z2	357881052	2020.10.30
3	EMI test Receiver	R&S	ESCI	834115/006	2020.11.01
4	Coaxial cable	ZDECL	Z302S-BNCJ-BNCJ-1.5M	18091904	2020.10.30
5	CE Test software	FALA	EZ-EMC	Ver. EMC-con3A1.1	N/A

Radiated Emission Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	869	2020.11.02
2	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	1911	2020.11.02
3	Preamplifier	Agilent	8449B	3008A01838	2020.11.01
4	Amplifier	HP	8447E	2945A02747	2020.11.01
5	Coaxial cable	ETS	RFC-SNS-100-NMS-80 NI	/	2020.11.01
6	Coaxial cable	ETS	RFC-SNS-100-NMS-20 NI	/	2020.11.01
7	Coaxial cable	ETS	RFC-SNS-100-SMS-20 NI	/	2020.11.01
8	Coaxial cable	ETS	RFC-NNS-100-NMS-300 NI	/	2020.11.01
9	EMI test Receiver	R&S	ESPI	100362	2020.11.01
10	MXA signal analyzer	Agilent	N9020A	MY52090073	2020.11.01
11	RE Test software	FALA	EZ-EMC	Ver. FA-03A2 RE	N/A

4. Measurement uncertainty

The following table is for the measurement uncertainty, which is calculated as per the document CISPR 16-4 and ANSI C63.4.

Test	Parameters	Expanded Uncertainty (U_{Lab})	Expanded Uncertainty (U_{Cispr})
Conducted Emission	Level Accuracy: 150kHz to 30MHz	±1.22 dB	±3.6 dB
Radiated Emission	Level Accuracy: 30MHz to 1000 MHz	±3.67 dB	±5.2 dB
Radiated Emission	Level Accuracy: Above 1000MHz	±4.79 dB	N/A

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

4.1. Operating condition of EUT

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively

Pretest Mode	Description
Mode	Charging+USB+HDMI

For Conducted Test	
Final Test Mode	Description
Mode	Charging+USB+HDMI

For Radiated Test	
Final Test Mode	Description
Mode	Charging+USB+HDMI

Charging, USB and HDMI three modes were tested at AC 120V/60Hz and AC230V/50Hz, only the worst result of Charging+USB+HDMI test mode for AC 120V/60Hz was reported.

4.2. Test conditions

Temperature: 15-35℃
Relative Humidity: 30-60 %
Atmospheric pressure: 800hPa-1060hPa

5. Conducted Emission

5.1. Limit

☐ Except for Class A devices:

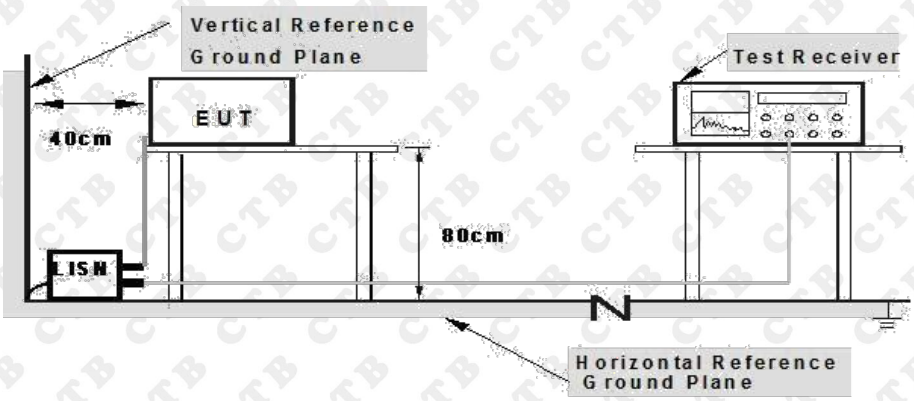
Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

☒ For Class A devices:

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

5.2. 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.

5.3. EMI Test Receiver Setup

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

5.4. Test procedure

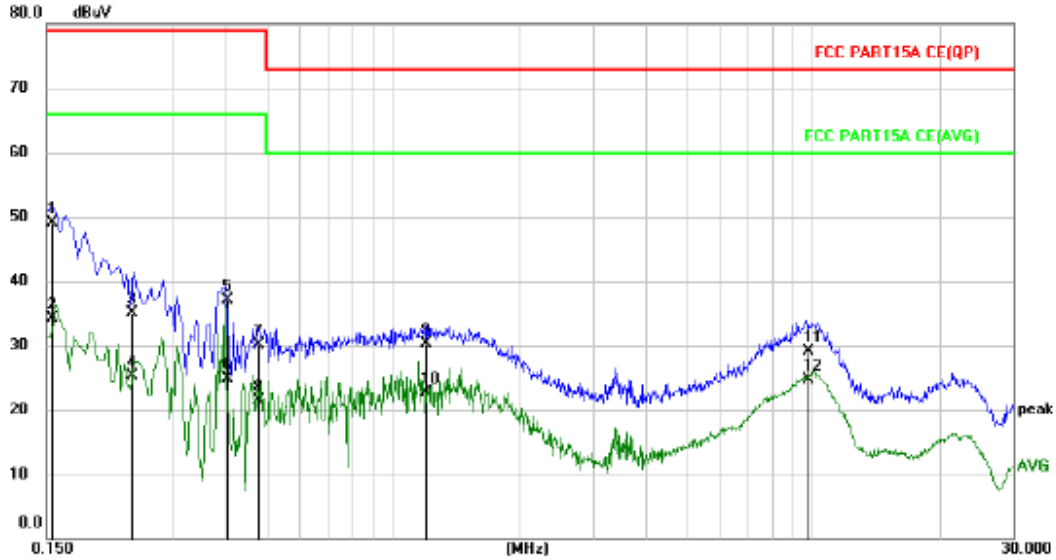
Measurement was performed in shielded room, and instruments used were followed clause 4 of ANSI C63.4.
Detailed test procedure was following clause 7 of ANSI C63.4.
Frequency range 150kHz – 30MHz was checked and EMI receiver measurement bandwidth was set to 9 kHz.

5.5. Test results

PASS

Please refer to the following page.

Polarization: L



Site 843 Chamber Phase: L1 Temperature: 24.5

Limit: FCC PART15ACE(QP) Power: AC120V/60Hz Humidity: 50 %

EUT: ISS(interactive smart shelf)

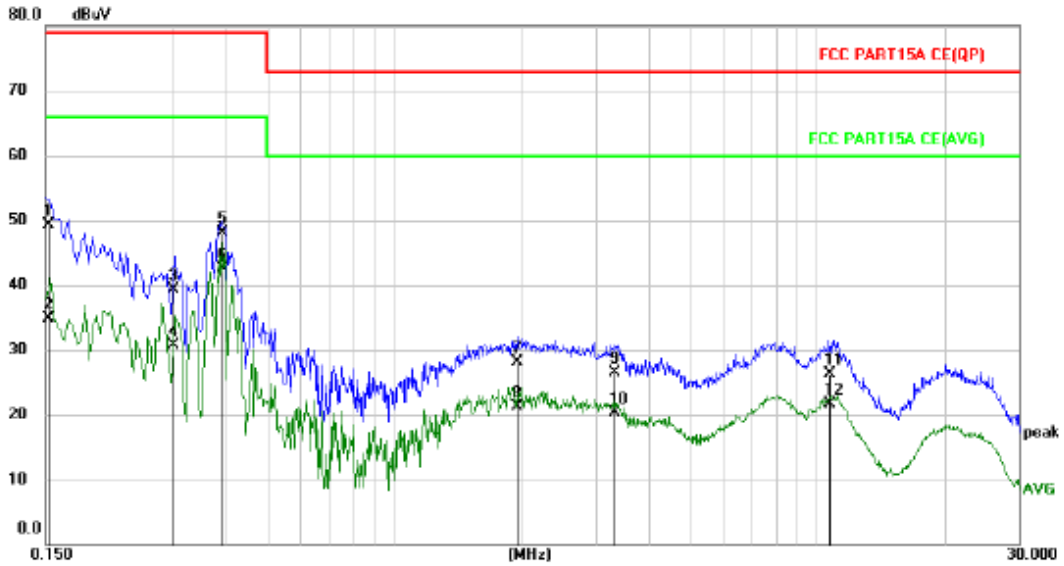
M/N: LD230EKS-FPN1

Mode: Charging+USB+HDMI

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1546	38.83	10.21	49.04	79.00	-29.96	QP	
2		0.1546	24.06	10.21	34.27	66.00	-31.73	AVG	
3		0.2394	24.84	10.19	35.03	79.00	-43.97	QP	
4		0.2394	15.20	10.19	25.39	66.00	-40.61	AVG	
5		0.4035	27.06	10.10	37.16	79.00	-41.84	QP	
6		0.4035	14.83	10.10	24.93	66.00	-41.07	AVG	
7		0.4776	20.13	10.06	30.19	79.00	-48.81	QP	
8		0.4776	11.47	10.06	21.53	66.00	-44.47	AVG	
9		1.2023	20.05	10.23	30.28	73.00	-42.72	QP	
10		1.2023	12.55	10.23	22.78	60.00	-37.22	AVG	
11		9.7504	18.62	10.54	29.16	73.00	-43.84	QP	
12		9.7504	14.25	10.54	24.79	60.00	-35.21	AVG	

Polarization: N



Site 843 Chamber Phase: N Temperature: 24.5

Limit: FCC PART15A CE(QP) Power: AC120V/60Hz Humidity: 50 %

EUT: ISS(interactive smart shelf)

M/N: D230EKS-FPN1

Mode: Charging+USB+HDMI

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1519	39.23	10.08	49.31	79.00	-29.69	QP	
2		0.1519	24.75	10.08	34.83	66.00	-31.17	AVG	
3		0.3001	29.22	10.16	39.38	79.00	-39.62	QP	
4		0.3001	20.45	10.16	30.61	66.00	-35.39	AVG	
5		0.3924	37.88	10.19	48.07	79.00	-30.93	QP	
6	*	0.3924	32.37	10.19	42.56	66.00	-23.44	AVG	
7		1.9411	17.90	10.13	28.03	73.00	-44.97	QP	
8		1.9411	11.26	10.13	21.39	60.00	-38.61	AVG	
9		3.3280	16.23	10.30	26.53	73.00	-46.47	QP	
10		3.3280	10.03	10.30	20.33	60.00	-39.67	AVG	
11		10.6977	15.70	10.64	26.34	73.00	-46.66	QP	
12		10.6977	11.14	10.64	21.78	60.00	-38.22	AVG	

6. Radiated emissions

6.1. Limit

☐ Except for Class A devices (at 3m):

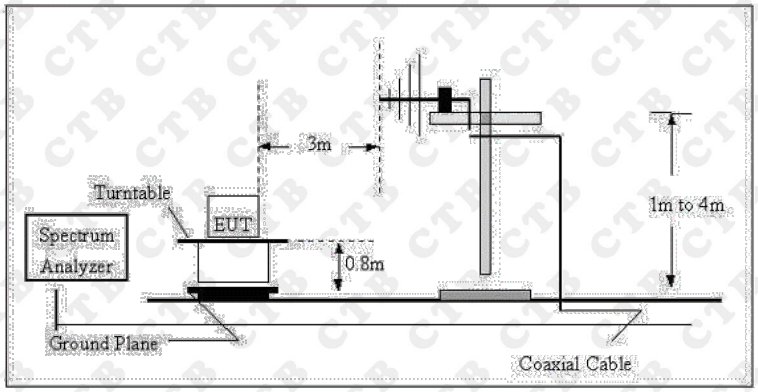
Frequency of emission (MHz)	Field strength (microvolts/meter)	
	(microvolts/meter)	(dBμV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

☒ For Class A devices (at 10m):

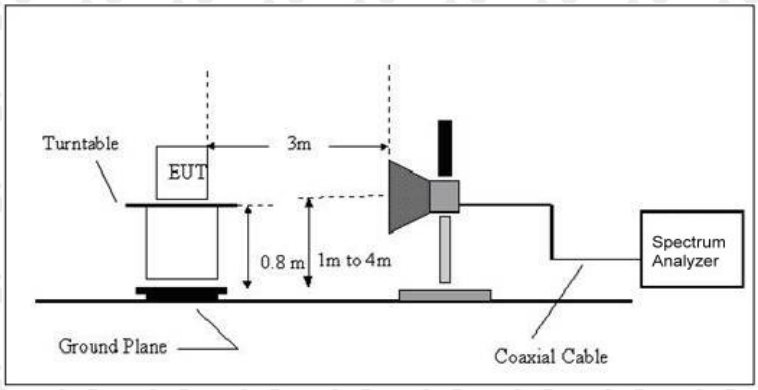
Frequency of emission (MHz)	Field strength (microvolts/meter)	
	(microvolts/meter)	(dBμV/m)
30-88	90	39
88-216	150	43.5
216-960	210	46.4
Above 960	300	49.5

6.2. 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 semi-anechoic(3m) test site, using the setup accordance with the ANSI C63.4:2014.

6.3. 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

6.4. Test procedure

The measurement was performed in a 3m semi-anechoic chamber, and instruments used were f ollowed clause 4 of ANSI C63.4.

Detailed test procedure was following clause 8 of ANSI C63.4.

Note: for the measurement distance other than 3m and 10m, the limit is varied according to 20dB /10 decades.

6.5. Corrected Amplitude & Margin Calculation

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:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

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:

Margin = Limit – Corrected Amplitude

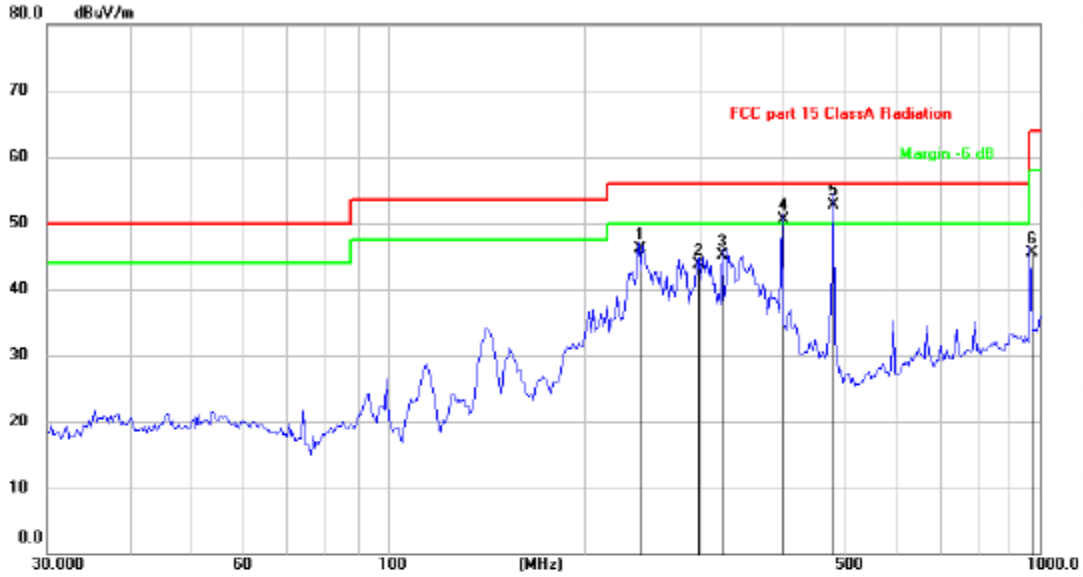
6.6. Test results

PASS

Please refer to the following page.

Below 1 G

Polarization: H



Site 966 Anechoic Chamber
Limit: FCC part 15 ClassA Radiation
EUT: ISS(interactive smart shelf)
M/N: D230EKS-FPN1
Mode: Charging+USB+HDMI
Note:

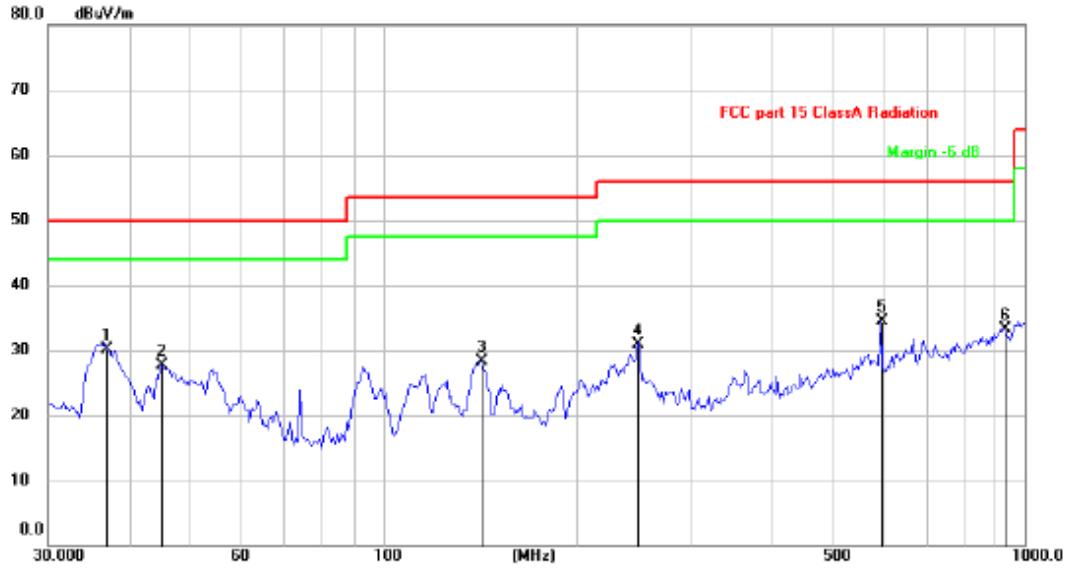
Polarization: *Horizontal*
Power: AC120V/60Hz
Distance: 3m

Temperature: 24.8
Humidity: 55 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector	cm	degree	Comment
1		242.5253	52.77	-6.74	46.03	56.00	-9.97	QP	195	46	
2		299.3158	49.52	-5.76	43.76	56.00	-12.24	QP	206	159	
3		325.5958	49.80	-4.69	45.11	56.00	-10.89	QP	247	146	
4	!	401.8385	52.55	-2.06	50.49	56.00	-5.51	QP	125	76	
5	*	479.8160	53.19	-0.45	52.74	56.00	-3.26	QP	100	0	
6		965.5421	37.76	7.77	45.53	64.00	-18.47	QP	146	19	

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

Polarization: V



Site 966 Anechoic Chamber
Limit: FCC part 15 ClassA Radiation
EUT: ISS(interactive smart shelf)
M/N: D230EKS-FPN1
Mode: Charging+USB+HDMI
Note:

Polarization: *Vertical*
Power: AC120V/60Hz
Distance: 3m

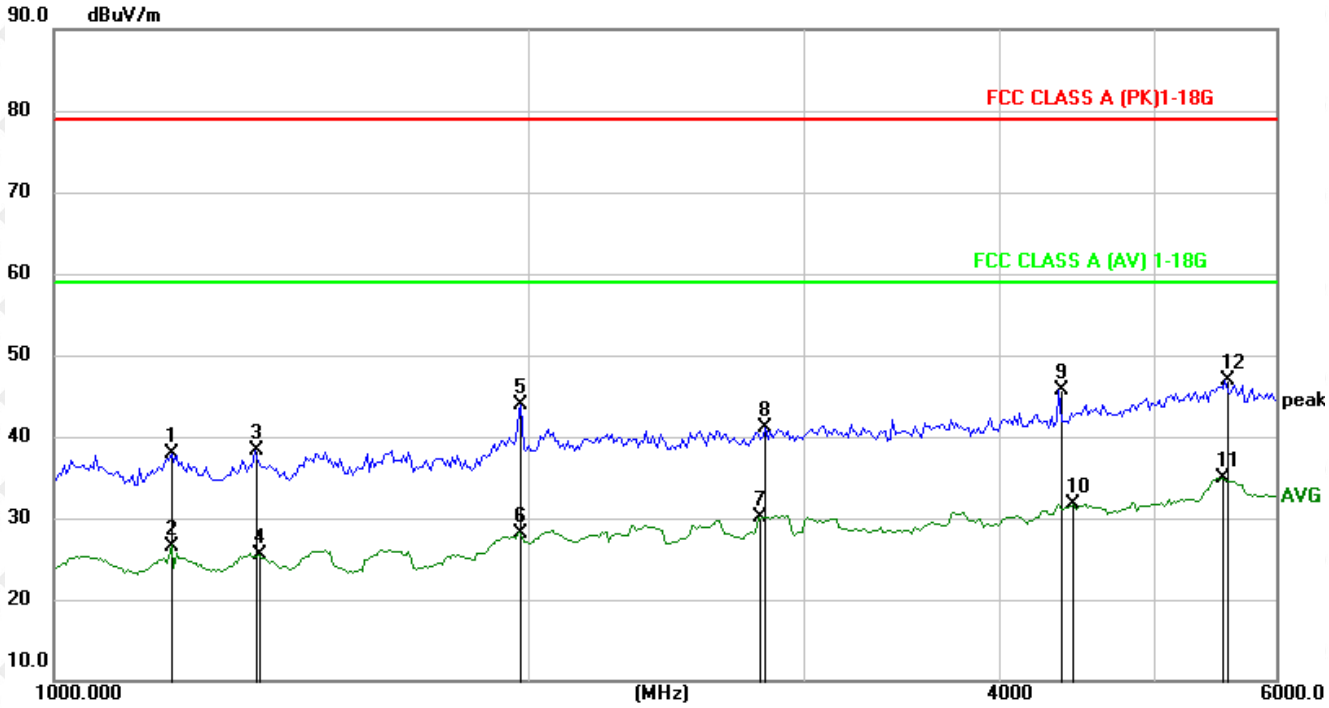
Temperature: 24.8
Humidity: 55 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector	cm	degree	Comment
1	*	36.7662	36.51	-6.37	30.14	50.00	-19.86	QP	102	43	
2		45.0583	33.54	-5.78	27.76	50.00	-22.24	QP	154	68	
3		141.3298	34.86	-6.47	28.39	53.50	-25.11	QP	168	179	
4		249.4250	37.87	-6.87	31.00	56.00	-25.00	QP	234	154	
5		595.1329	32.46	1.95	34.41	56.00	-21.59	QP	275	265	
6		925.7563	26.08	7.31	33.39	56.00	-22.61	QP	166	247	

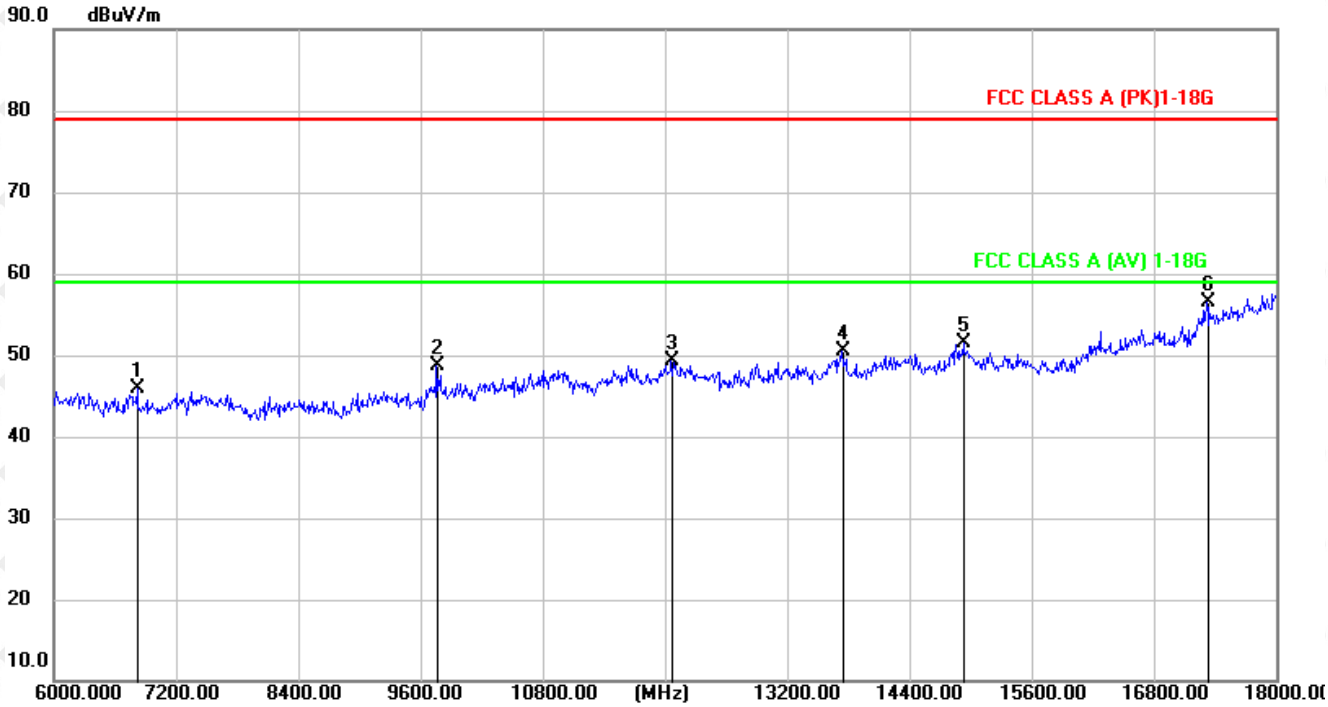
Note: Result=Reading+Factor
Over Limit=Result-Limit

Above 1 G

Polarization: H



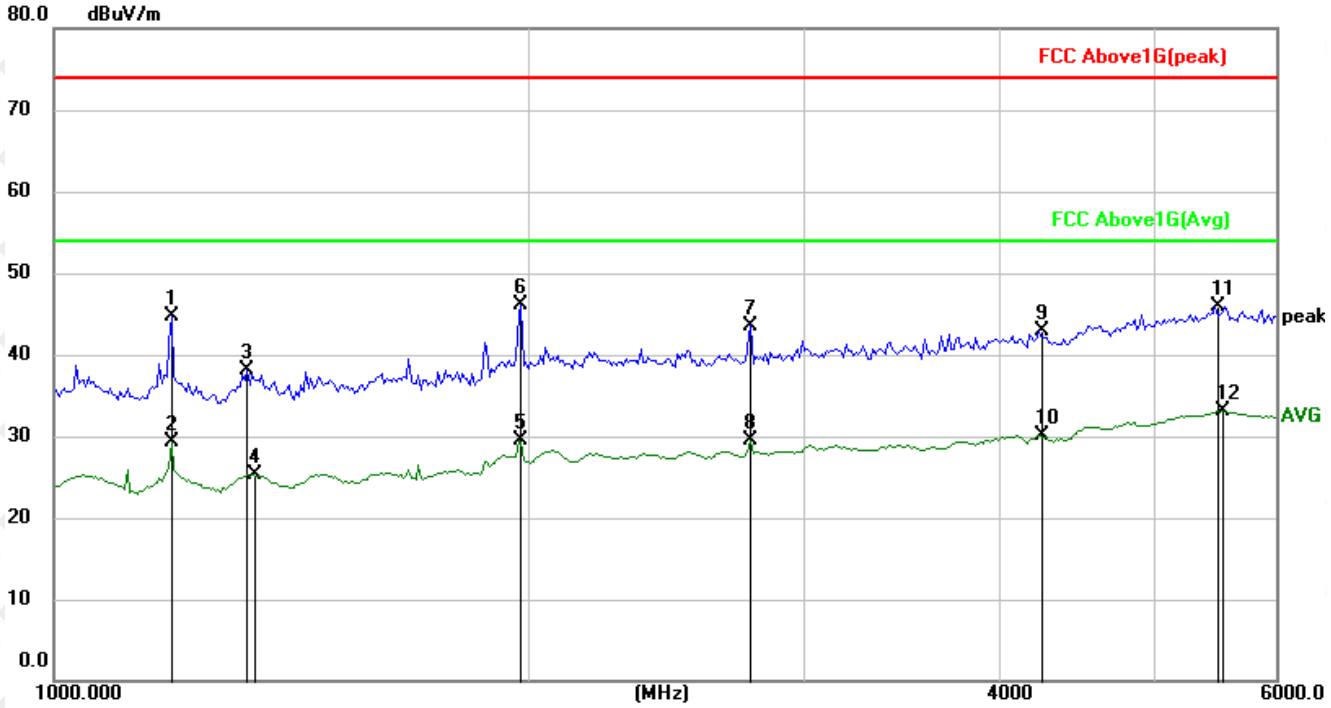
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		1187.688	45.06	-7.19	37.87	79.00	-41.13	peak
2		1187.688	33.79	-7.19	26.60	59.00	-32.40	AVG
3		1341.581	44.58	-6.35	38.23	79.00	-40.77	peak
4		1351.230	31.74	-6.30	25.44	59.00	-33.56	AVG
5		1982.685	45.53	-1.64	43.89	79.00	-35.11	peak
6		1982.685	29.71	-1.64	28.07	59.00	-30.93	AVG
7		2806.824	29.64	0.54	30.18	59.00	-28.82	AVG
8		2837.161	40.39	0.63	41.02	79.00	-37.98	peak
9		4361.545	40.66	5.08	45.74	79.00	-33.26	peak
10		4456.338	26.34	5.41	31.75	59.00	-27.25	AVG
11	*	5545.141	25.44	9.43	34.87	59.00	-24.13	AVG
12		5565.048	37.44	9.43	46.87	79.00	-32.13	peak



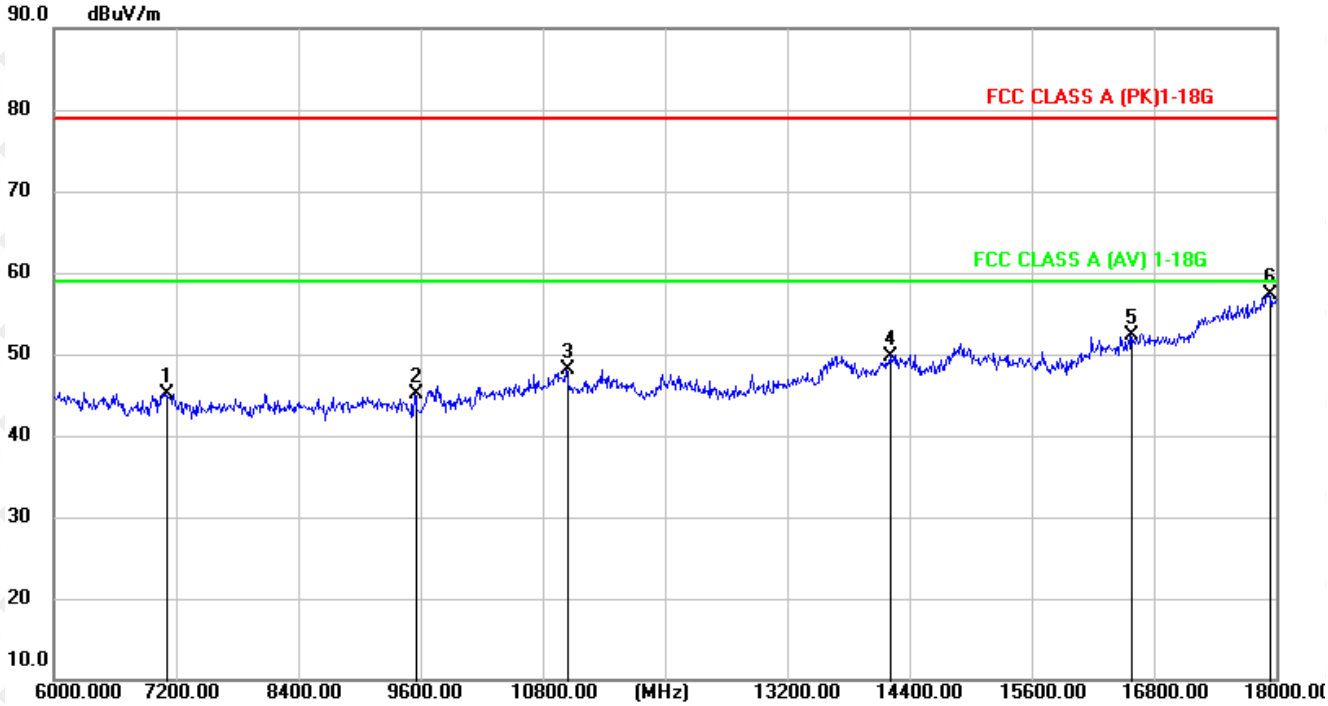
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		6816.000	33.30	12.58	45.88	79.00	-33.12	peak
2		9757.200	31.15	17.60	48.75	79.00	-30.25	peak
3		12067.200	29.33	20.01	49.34	79.00	-29.66	peak
4		13743.600	28.67	21.82	50.49	79.00	-28.51	peak
5		14937.600	28.14	23.28	51.42	79.00	-27.58	peak
6	*	17320.800	29.36	27.08	56.44	79.00	-22.56	peak

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

Polarization: V



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		1187.688	51.93	-7.19	44.74	74.00	-29.26	peak
2		1187.688	36.50	-7.19	29.31	54.00	-24.69	AVG
3		1327.235	44.52	-6.44	38.08	74.00	-35.92	peak
4		1336.782	31.69	-6.37	25.32	54.00	-28.68	AVG
5		1975.593	31.18	-1.74	29.44	54.00	-24.56	AVG
6		1982.685	47.76	-1.64	46.12	74.00	-27.88	peak
7		2776.810	43.16	0.44	43.60	74.00	-30.40	peak
8		2776.810	29.06	0.44	29.50	54.00	-24.50	AVG
9		4238.283	38.17	4.67	42.84	74.00	-31.16	peak
10		4238.283	25.37	4.67	30.04	54.00	-23.96	AVG
11		5485.847	36.52	9.41	45.93	74.00	-28.07	peak
12	*	5545.141	23.70	9.43	33.13	54.00	-20.87	AVG

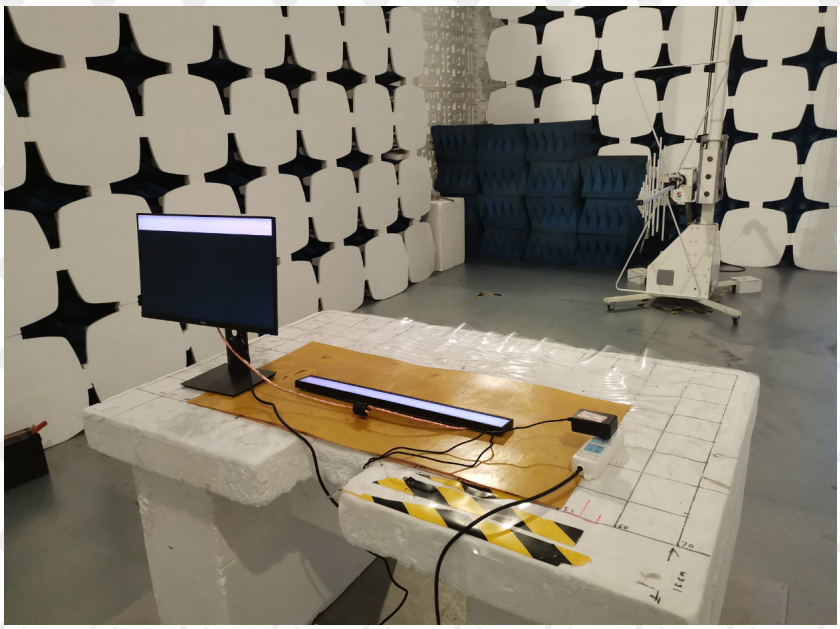


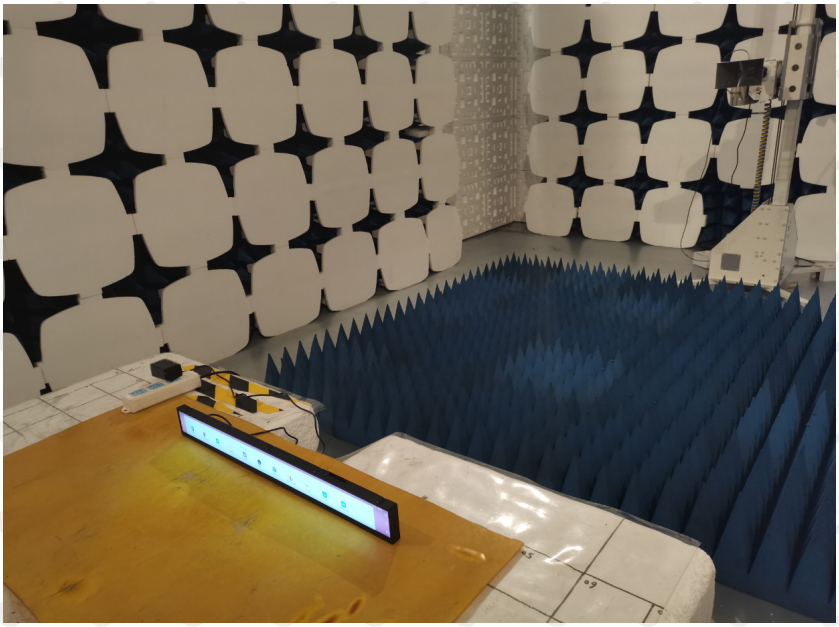
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		7100.400	31.74	13.40	45.14	79.00	-33.86	peak
2		9542.400	28.24	16.94	45.18	79.00	-33.82	peak
3		11034.000	27.25	20.78	48.03	79.00	-30.97	peak
4		14216.400	27.20	22.60	49.80	79.00	-29.20	peak
5		16579.200	28.47	23.92	52.39	79.00	-26.61	peak
6	*	17930.400	27.30	30.06	57.36	79.00	-21.64	peak

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

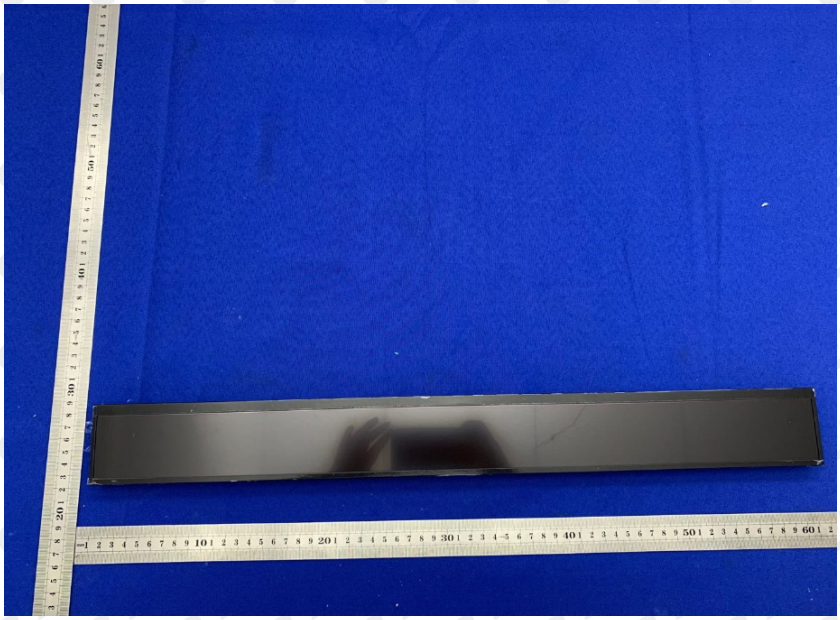
7. Photographs of test setup

Photograph of test setup for Conducted Emission

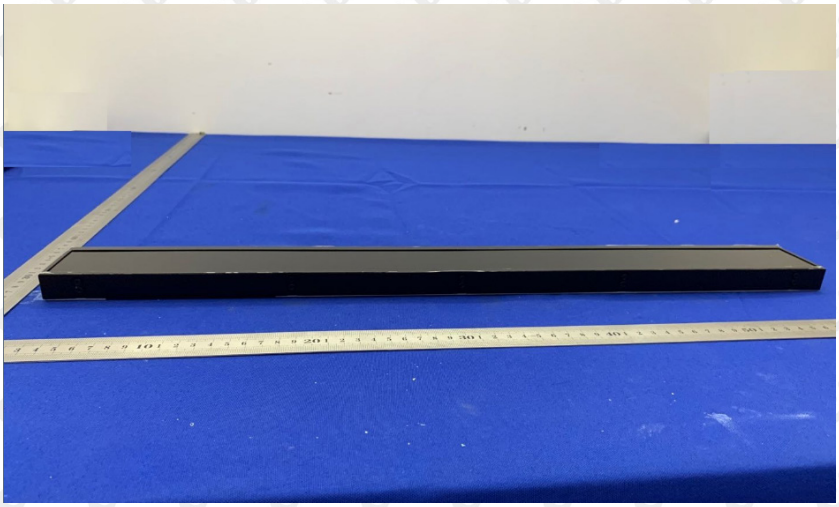
Photograph of test setup for Radiated Emission below 1 G


Photograph of test setup for Radiated Emission above 1 G


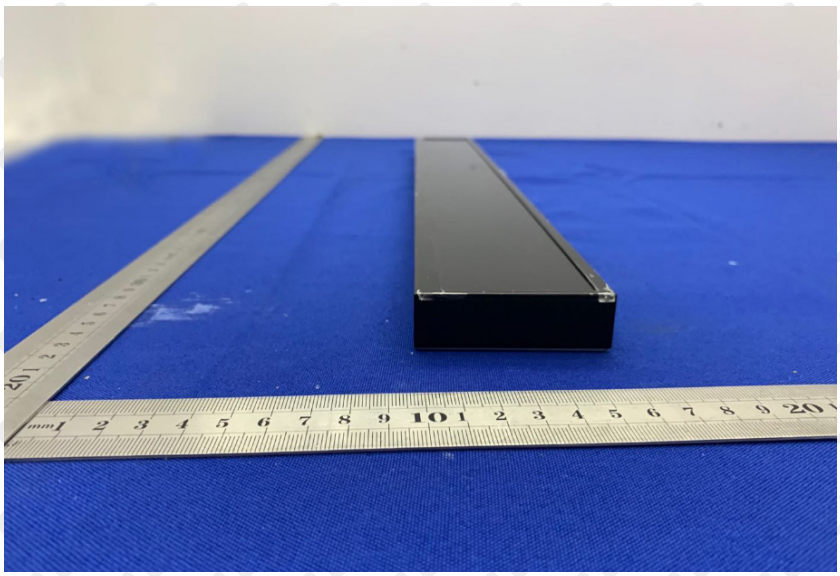
8. Photographs of EUT

Photographs of EUT


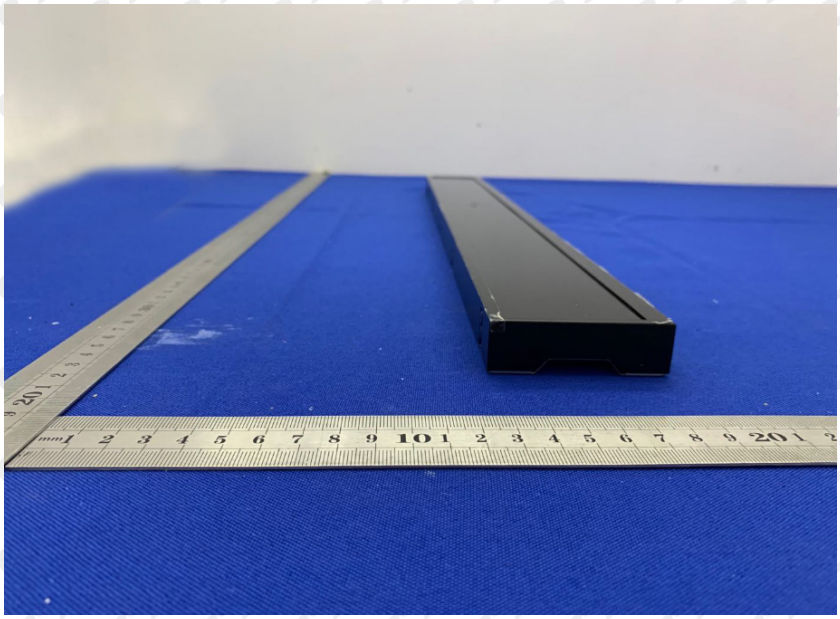
Photographs of EUT

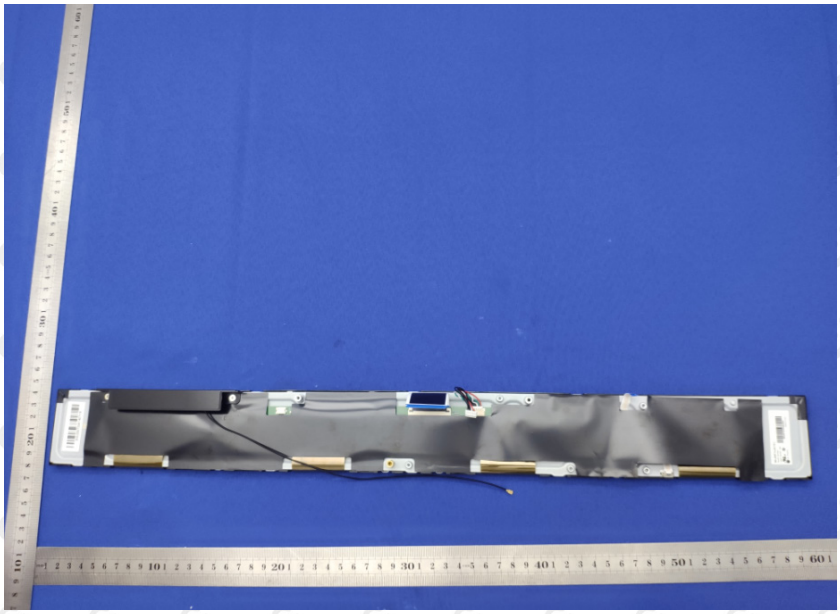


Photographs of EUT

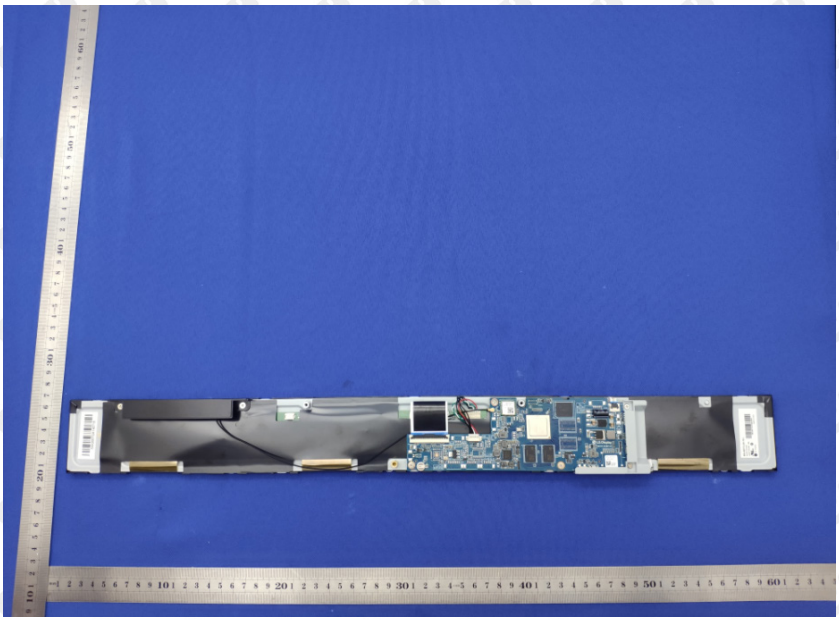


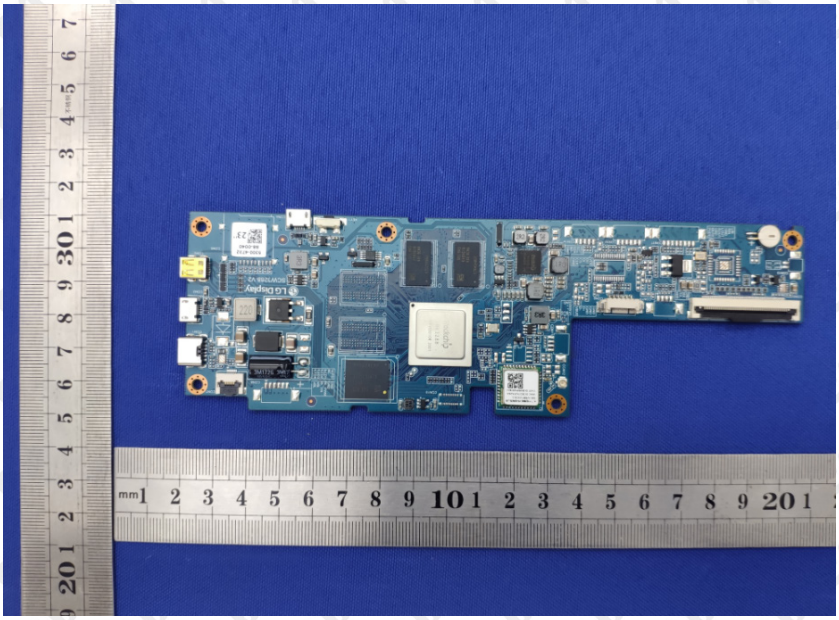
Photographs of EUT



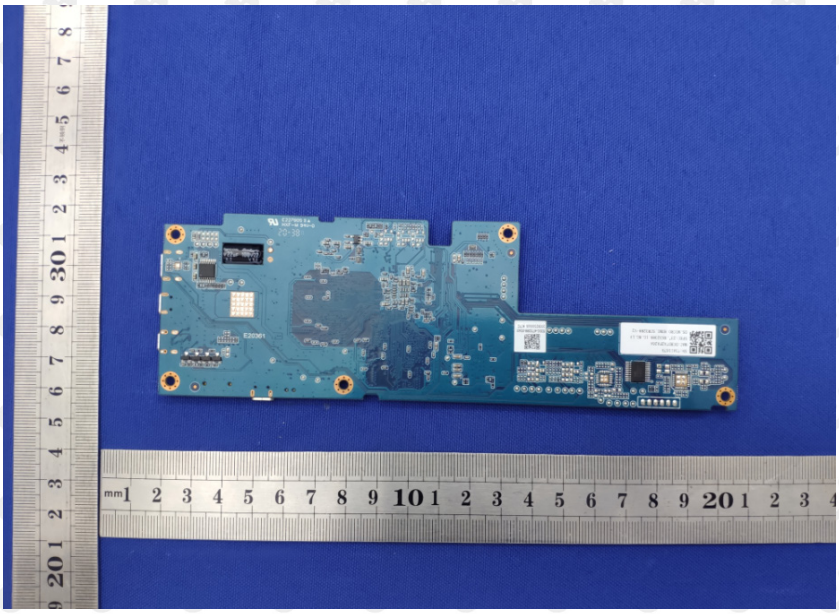


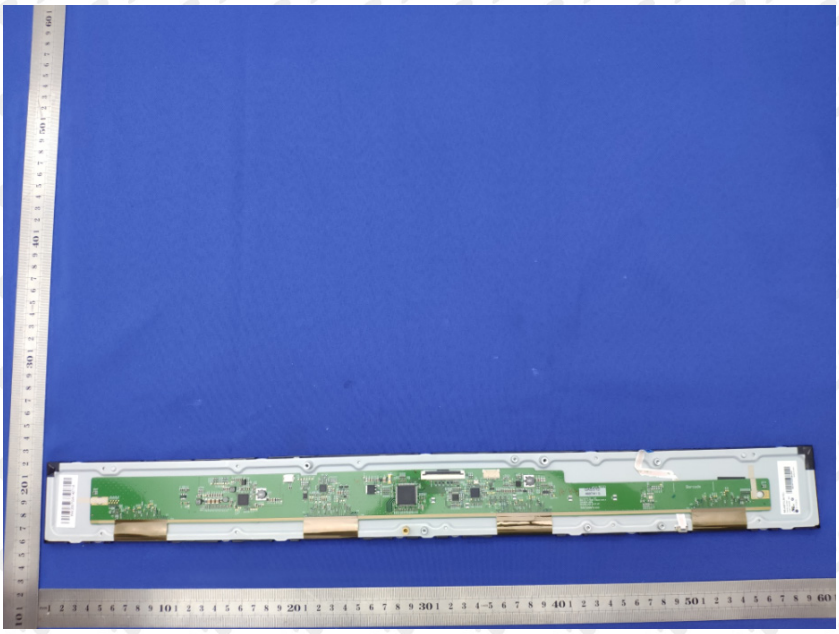
Photographs of EUT



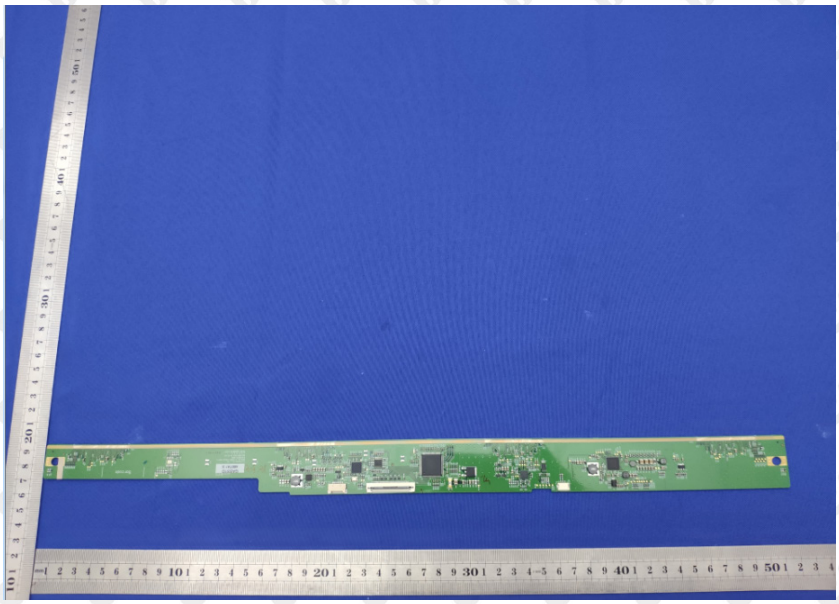


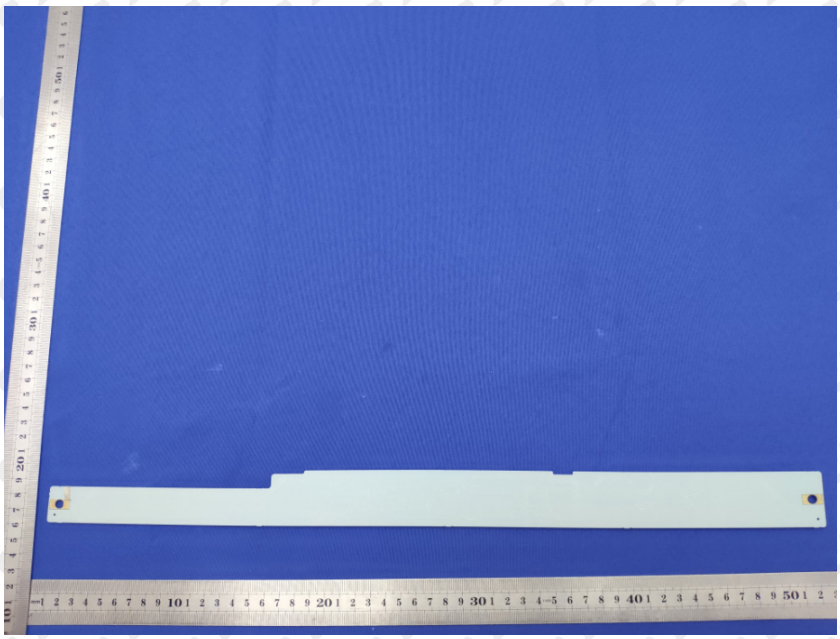
Photographs of EUT





Photographs of EUT





End of report