


# FCC Radio Test Report

**FCC ID: ARS-ES073EYBM20**

**This report concerns: Class II Permissive Change**

**Equipment** : ePaper Signage  
**Brand Name** : N/A  
**Test Model** : ES073EYBM20  
**Series Model** : ES073ENBM30  
**Applicant** : Top Victory Electronics (Taiwan) Co.,Ltd  
**Address** : 10F., No.230, Liancheng Rd. Zhonghe Dist., New Taipei City, 23553 Taiwan  
**Manufacturer** : Top Victory Electronics (Taiwan) Co.,Ltd  
**Address** : 10F., No.230, Liancheng Rd. Zhonghe Dist., New Taipei City, 23553 Taiwan  
**Date of Receipt** : Aug. 01, 2023  
**Date of Test** : Aug. 02, 2023~Aug. 10, 2023  
**Issued Date** : Aug. 11, 2023  
**Report Version** : R00  
**Test Sample** : POC230714013-S001  
**Standard(s)** : FCC CFR Title 47, Part 15, Subpart C  
 ANSI C63.10-2013

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## REPORT ISSUED HISTORY

Report No.	Version	Description	Issued Date	Note
RF230714013-01-001	R00	Compared with original report (FCC022023-00226RF0), Added series model: ES073ENBM30, change panel and then the ADC switch function is canceled on the hardware, and the mirco USB anti-mis-interpolation function is added and the NFC RF circuit does not change. So test items is radiated emissions 30MHz-1000MHz and AC Power Conducted Emission, Other are kept the same.	Aug. 11, 2023	Valid

## 1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

FCC CFR Title 47, Part 15, Subpart C				
Standard(s) Section	Test Item	Test Result	Judgment	Remark
15.207	AC Power Line Conducted Emissions	APPENDIX A	PASS	-----
15.225(a)-(d) 15.205(a) 15.209(a)	Radiated Emission	APPENDIX B APPENDIX C	PASS	-----
15.225(e)	Frequency Tolerance	APPENDIX D	Verified <sup>Note3</sup>	-----
15.215(c)	Bandwidth	APPENDIX E	Verified <sup>Note3</sup>	-----
15.203	Antenna Requirement	-----	PASS	Note(2)

Note:

- (1) "N/A" denotes test is not applicable in this test report
- (2) The device what use a permanently attached antenna were considered sufficient to comply with the provisions of 15.203.
- (3) For test data, please refer to the report FCC022023-00226RF0.

### 1.1 TEST FACILITY

Company:	Shenzhen Haiyun Standard Technical CO., Ltd.
Address:	No. 110-113, 115, 116, Block B, Jinyuan Business Building, Bao'an District, Shenzhen, China
CNAS Registration Number:	CNAS L18252
CAB identifier:	CN0145
A2LA Certificate Number:	6823.01
Telephone:	0755-26024411

### 1.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT.

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

Uncertainty	
Parameter	Uncertainty
Occupied Channel Bandwidth	$\pm 143.88\text{kHz}$
RF power conducted	$\pm 0.384\text{dB}$
Conducted emission(9kHz~30MHz) AC main	$\pm 2.72\text{dB}$
Radiated emission(9kHz~30MHz)	$\pm 2.66\text{dB}$
Radiated emission (30MHz~1GHz)	$\pm 4.62\text{dB}$
Radiated emission (1GHz~18GHz)	$\pm 4.86\text{dB}$
Radiated emission (18GHz~40GHz)	$\pm 3.80\text{dB}$

### 1.3 TEST ENVIRONMENT CONDITIONS

Test Item	Temperature	Humidity	Test Voltage	Tested By
AC Power Line Conducted Emissions	25.2°C	49%	AC 120V/60Hz	Albert Fan
Radiated Emissions-9kHz to 30MHz	23.3°C	52%	AC 120V/60Hz	Albert Fan
Radiated Emissions-30MHz to 1000MHz	23.3°C	52%	AC 120V/60Hz	Albert Fan

## 2. GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF EUT

Equipment	ePaper Signage
Brand Name	N/A
Test Model	ES073EYBM20
Series Model	ES073ENBM30
Model Difference(s)	Only the model name is different
Power Source	DC 3.85V from lithium battery
Power Rating	DC 5V
Operation Frequency	13.56 MHz
Antenna Type	PIFA

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

2. Channel List:

Test Channel	Test Frequency (MHz)
01	13.56

## 2.2 DESCRIPTION OF TEST MODES

The test system was pre-tested based on the consideration of all possible combinations of EUT operation mode.

Pretest Mode	Description
Mode 1	TX Mode_13.56MHz

Following mode(s) was (were) found to be the worst case(s) and selected for the final test.

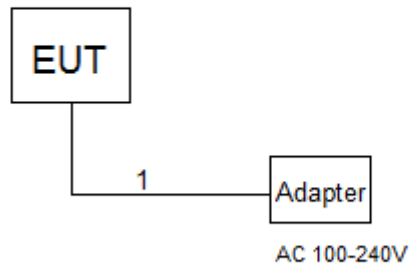
<b>AC power line conducted emissions test</b>	
Final Test Mode	Description
Mode 1	TX Mode_13.56MHz

<b>Radiated emissions test - Below 1GHz</b>	
Final Test Mode	Description
Mode 1	TX Mode_13.56MHz

<b>Conducted test</b>	
Final Test Mode	Description
Mode 1	TX Mode_13.56MHz



### 2.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



### 2.4 SUPPORT UNITS

Item	Equipment	Mfr/Brand	Model	Series No.
A	Adapter	HUAWEI	HW-100225C00	/

Item	Cable Type	Shielded Type	Ferrite Core	Length
1	Type-C Cable	NO	NO	1m

### 3. AC POWER LINE CONDUCTED EMISSIONS

#### 3.1 LIMIT

Frequency of Emission (MHz)	Limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56*	56 to 46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " \* " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

#### 3.2 TEST PROCEDURE

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item - EUT Test Photos.

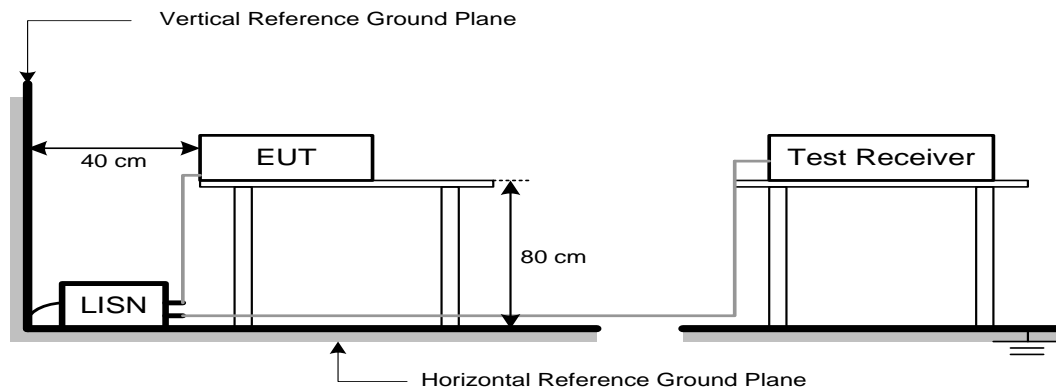
The following table is the setting of the receiver

Receiver Parameter	Setting
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

#### 3.3 DEVIATION FROM TEST STANDARD

No deviation.

### 3.4 TEST SETUP



### 3.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical function (as a customer would normally use it), EUT was programmed to be in continuously transmitting data or hopping on mode.

### 3.6 TEST RESULTS

Please refer to the APPENDIX A.

Remark:

- (1) All readings are QP Mode value unless otherwise stated AVG in column of 『Note』 . If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform in this case, a "\*" marked in AVG Mode column of Interference Voltage Measured.
- (2) Measuring frequency range from 150 kHz to 30 MHz.

## 4. RADIATED EMISSION

### 4.1 LIMIT

#### §15.225 (a)

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

#### §15.225 (b)

Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

#### §15.225 (c)

Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

#### §15.225 (d)

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

#### §15.209 (a)

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

#### LIMITS OF RADIATED EMISSION MEASUREMENT (9 kHz-1000 MHz)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

#### Note:

- (1) The limit for radiated test was performed according to FCC CFR Title 47, Part 15, Subpart C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dB $\mu$ V/m)=20log Emission level ( $\mu$ V/m).

## 4.2 TEST PROCEDURE

The test set-up was made in accordance to the general provisions of ANSI C63.10-2013. The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna. The radiated emissions measurements were made in a typical installation configuration.

Sweep the whole frequency band through the range from 9 kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

During the test, below 30MHz, the center of the loop shall be 1 meters; above 30MHz, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna. The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing.

Spectrum Parameters	Setting
Start ~ Stop Frequency	9 kHz~150 kHz for RBW 200 Hz
Start ~ Stop Frequency	0.15 MHz~30 MHz for RBW 9 kHz
Start ~ Stop Frequency	30 MHz~1000 MHz for RBW 100 kHz

Receiver Parameters	Setting
Start ~ Stop Frequency	9 kHz~90 kHz for PK/AVG detector
Start ~ Stop Frequency	90 kHz~110 kHz for QP detector
Start ~ Stop Frequency	110 kHz~490 kHz for PK/AVG detector
Start ~ Stop Frequency	490 kHz~30 MHz for QP detector
Start ~ Stop Frequency	30 MHz~1000 MHz for QP detector

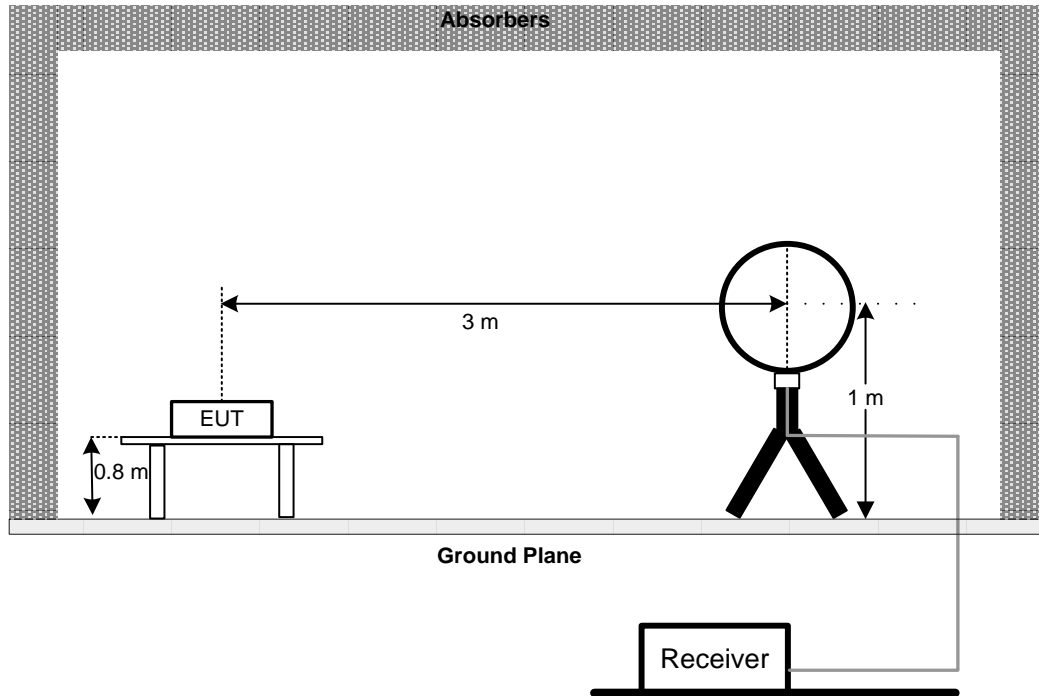
The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

## 4.3 DEVIATION FROM TEST STANDARD

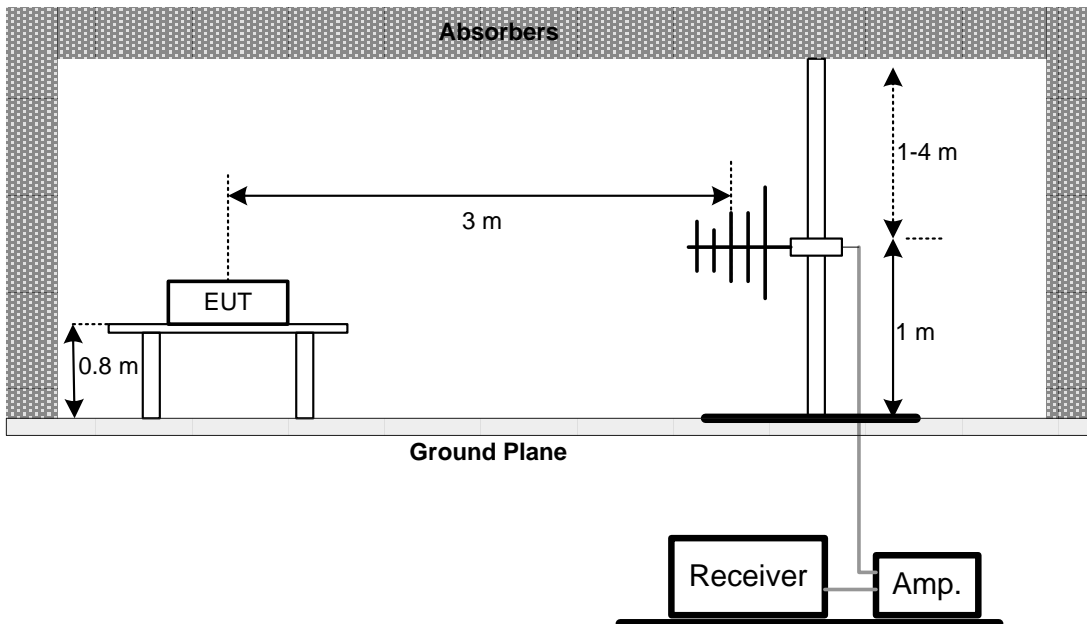
No deviation.

#### 4.4 TEST SETUP

##### 9 kHz to 30 MHz



##### 30 MHz to 1000 MHz



#### **4.5 EUT OPERATING CONDITIONS**

The EUT was programmed to be in continuously transmitting mode.

#### **4.6 TEST RESULTS - 9 kHz TO 30 MHz**

Please refer to the APPENDIX B.

Remark:

- (1) Distance extrapolation factor =  $40 \log(\text{specific distance} / \text{test distance})$  (dB).
- (2) Limit line = specific limits (dB $\mu$ V) + distance extrapolation factor.

#### **4.7 TEST RESULTS - 30 MHz TO 1000 MHz**

Please refer to the APPENDIX C.

## 5. FREQUENCY TOLERANCE

### 5.1 LIMIT

Section	Test Item	Limit
FCC 15.225(e)	Frequency Tolerance	$\pm 1.356$ kHz

### 5.2 TEST PROCEDURE

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of  $-20$  degrees to  $+ 50$  degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### 5.3 DEVIATION FROM STANDARD

No deviation.

### 5.4 TEST SETUP



### 5.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 unless otherwise a special operating condition is specified in the follows during the testing.

### 5.6 TEST RESULTS

Please refer to the APPENDIX D.



## 6. BANDWIDTH TEST

### 6.1 LIMIT

Section	Test Item	Limit
15.215(c)	20 dB Bandwidth	-

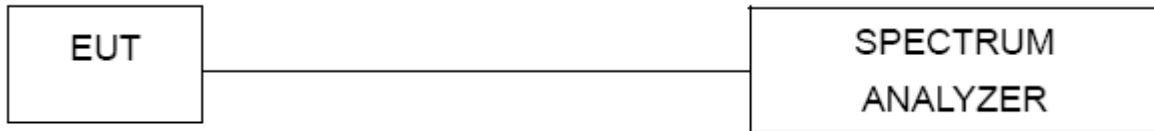
### 6.2 TEST PROCEDURE

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Spectrum Setting: RBW= 10 kHz, VBW=10 kHz, Sweep time = 5ms.

### 6.3 DEVIATION FROM STANDARD

No deviation.

### 6.4 TEST SETUP



### 6.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

### 6.6 TEST RESULTS

Please refer to the APPENDIX E.

## 7. MEASUREMENT INSTRUMENTS LIST

Radiated Emissions						
No.	Equipment	Manufacturer	Type No.	Serial No.	Cal. date (yyyy/mm/dd)	Cal. Due date (yyyy/mm/dd)
1	Test receiver	Rohde&Schwarz	ESU	100184	2023/5/3	2024/5/2
2	Low frequency amplifier	Unknown	LNA 0920N	2014	2023/5/3	2024/5/2
3	Loop Antenna	Schwarzbeck	FMZB1519 B	00029	2022/7/4	2025/7/3
4	Log periodic antenna	Schwarzbeck	VULB 9168	1151	2023/4/23	2024/4/22
5	Temp&Humidity Recorder	Meideshi	JR900	/	2023/5/3	2024/5/2
6	RF cable(966 chamber)9kHz-1 GHz	Unknown	Unknown	Unknown	2023/5/3	2024/5/2
7	RF cable(966 chamber)1GHz-1 8GHz	Unknown	Unknown	Unknown	2023/5/3	2024/5/2
8	Test software	Farad Technology Co., Ltd	EZ-EMC	/	/	/

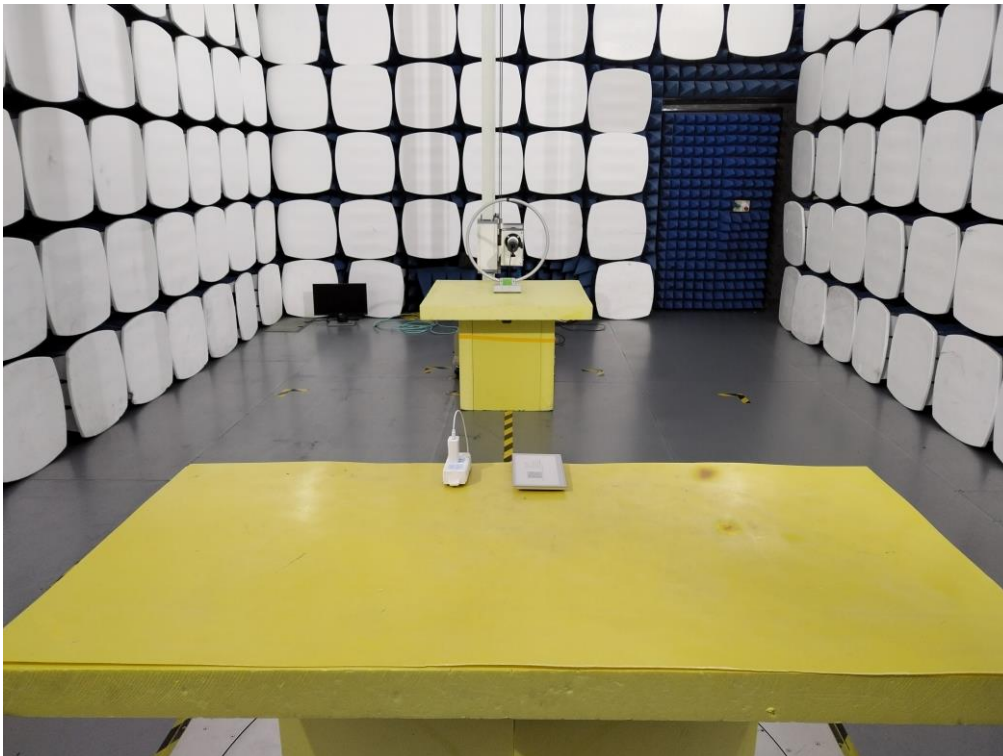
Conducted Emission						
No.	Equipment	Manufacturer	Type No.	Serial No.	Cal. date (yyyy/mm/dd)	Cal. Due date (yyyy/mm/dd)
1	Test receiver	Rohde&Schwarz	ESCI	100718	2023/5/3	2024/5/2
2	LISN	Rohde&Schwarz	ENV216	100075	2023/5/3	2024/5/2
3	Pulse limiter	Rohde&Schwarz	ESH3-Z2	102299	2023/5/3	2024/5/2
4	RF cable (9kHz-30MHz)	Unknown	Unknown	Unknown	2023/5/3	2024/5/2
5	Test software	Farad Technology Co., Ltd	EZ-EMC	/	/	/

## 8. EUT TEST PHOTO

### AC Power Line Conducted Emissions Test Photos

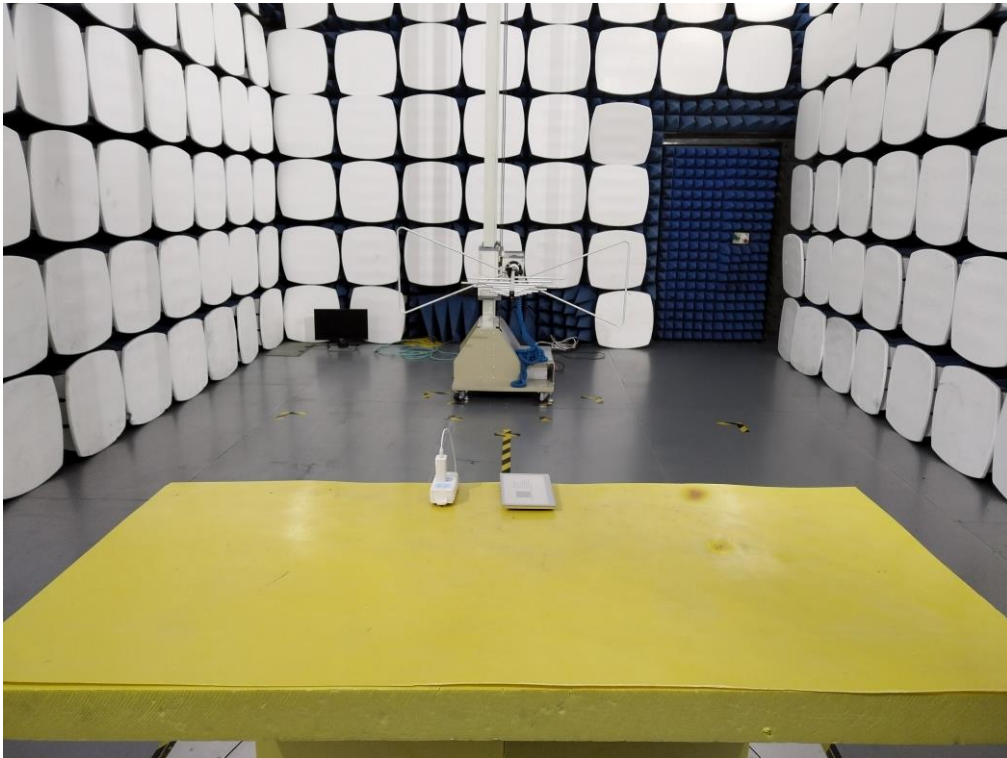


### Radiated Emissions Test Photos 9 kHz to 30 MHz



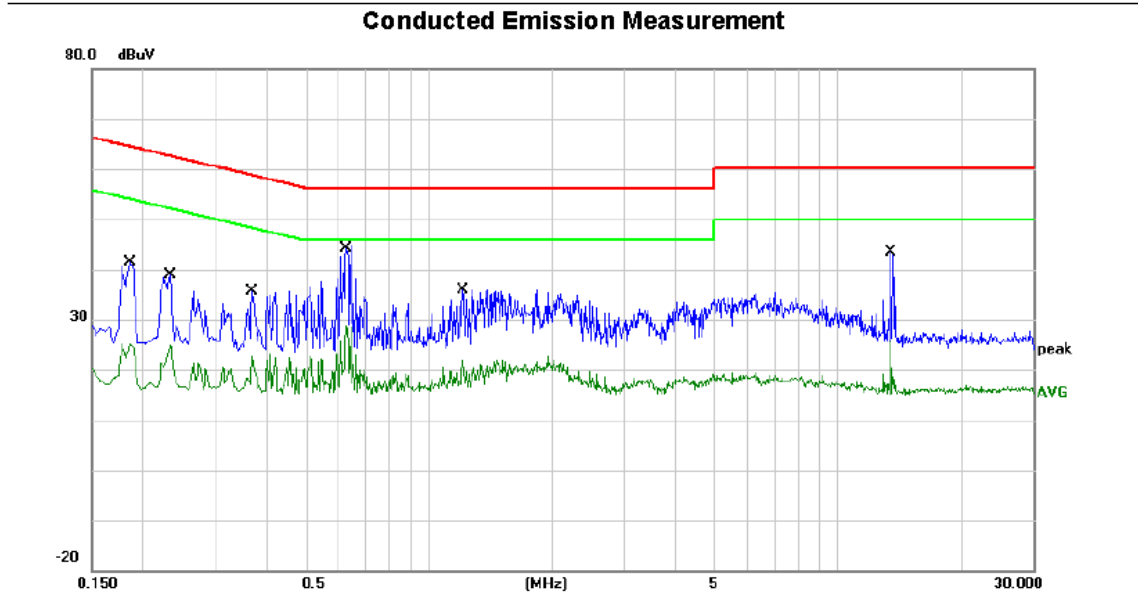
**Radiated Emissions Test Photos**

**30 MHz to 1000 MHz**



## APPENDIX A - AC POWER LINE CONDUCTED EMISSIONS

Test Mode	TX Mode_13.56MHz	Phase	Line
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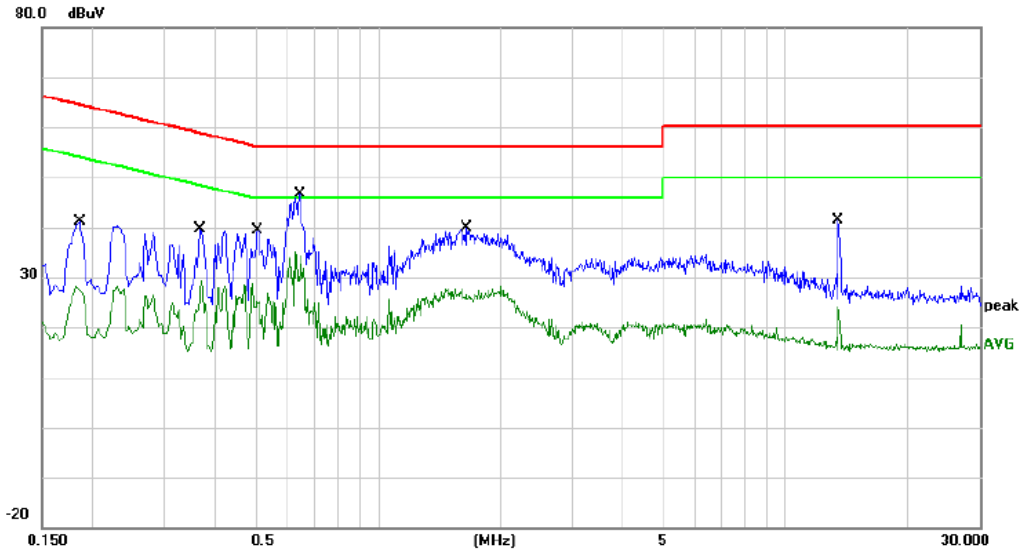
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1860	17.58	19.88	37.46	64.21	-26.75	QP	
2		0.1860	2.64	19.88	22.52	54.21	-31.69	AVG	
3		0.2340	15.02	19.88	34.90	62.31	-27.41	QP	
4		0.2340	2.05	19.88	21.93	52.31	-30.38	AVG	
5		0.3700	9.09	19.88	28.97	58.50	-29.53	QP	
6		0.3700	-1.36	19.88	18.52	48.50	-29.98	AVG	
7	*	0.6300	21.37	19.88	41.25	56.00	-14.75	QP	
8		0.6300	3.47	19.88	23.35	46.00	-22.65	AVG	
9		1.2100	7.75	19.88	27.64	56.00	-28.36	QP	
10		1.2100	-1.95	19.88	17.94	46.00	-28.06	AVG	
11		13.5380	12.38	19.99	32.37	60.00	-27.63	QP	
12		13.5380	-4.21	19.99	15.78	50.00	-34.22	AVG	

**REMARKS:**

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value - Limit Value.

Test Mode	TX Mode_13.56MHz	Phase	Neutral
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### Conducted Emission Measurement



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1860	18.62	19.88	38.50	64.21	-25.71	QP	
2		0.1860	5.51	19.88	25.39	54.21	-28.82	AVG	
3		0.3660	13.43	19.88	33.31	58.59	-25.28	QP	
4		0.3660	2.56	19.88	22.44	48.59	-26.15	AVG	
5		0.5100	14.70	19.88	34.58	56.00	-21.42	QP	
6		0.5100	3.74	19.88	23.62	46.00	-22.38	AVG	
7	*	0.6460	22.37	19.88	42.25	56.00	-13.75	QP	
8		0.6460	9.38	19.88	29.26	46.00	-16.74	AVG	
9		1.6580	12.34	19.90	32.24	56.00	-23.76	QP	
10		1.6580	5.13	19.90	25.03	46.00	-20.97	AVG	
11		13.5180	10.15	19.99	30.14	60.00	-29.86	QP	
12		13.5180	-4.41	19.99	15.58	50.00	-34.42	AVG	

**REMARKS:**

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value - Limit Value.

## APPENDIX B - RADIATED EMISSION - 9 KHZ TO 30 MHZ

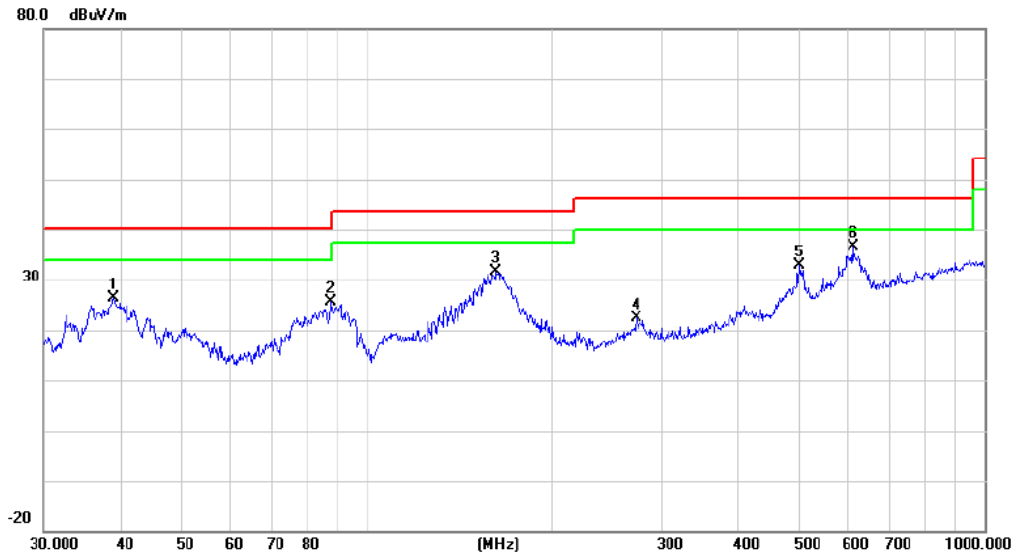


For test data, please refer to the report FCC022023-00226RF0.

## APPENDIX C - RADIATED EMISSION - 30 MHZ TO 1000 MHZ

Test Mode	TX Mode_13.56MHz	Polarization	Vertical
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### Radiated Emission

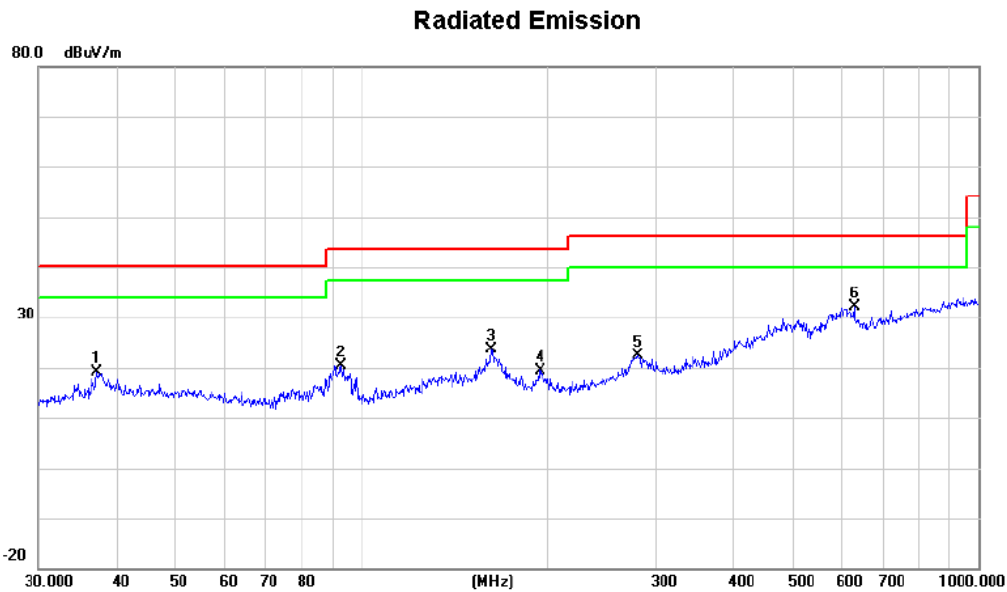


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB/m	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		38.8878	37.16	-10.82	26.34	40.00	-13.66	peak
2		87.4177	40.32	-14.61	25.71	40.00	-14.29	peak
3		162.0414	41.04	-9.43	31.61	43.50	-11.89	peak
4		273.2341	31.29	-8.95	22.34	46.00	-23.66	peak
5		501.1790	36.39	-3.45	32.94	46.00	-13.06	peak
6	*	612.0642	37.11	-0.41	36.70	46.00	-9.30	peak

**REMARKS:**

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value - Limit Value.

Test Mode	TX Mode_13.56MHz	Polarization	Horizontal
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No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB/m	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		37.2855	30.21	-11.15	19.06	40.00	-20.94	peak
2		92.7871	34.78	-14.37	20.41	43.50	-23.09	peak
3		162.6106	32.99	-9.47	23.52	43.50	-19.98	peak
4		195.1365	30.83	-11.47	19.36	43.50	-24.14	peak
5		281.0075	31.08	-8.73	22.35	46.00	-23.65	peak
6	*	629.4772	32.21	-0.16	32.05	46.00	-13.95	peak

**REMARKS:**

(1) Measurement Value = Reading Level + Correct Factor.

(2) Margin Level = Measurement Value - Limit Value.

## APPENDIX D - FREQUENCY TOLERANCE

For test data, please refer to the report FCC022023-00226RF0.

## APPENDIX E - BANDWIDTH

For test data, please refer to the report FCC022023-00226RF0.

**End of Test Report**