Shenzhen CTL Testing Technology Co., Ltd.
Tel: +86-755-89486194 E-mail: ctl@ctl-lab.com

TEST REPORT

FCC PART 15.225

Report Reference No. ..... :	**CTL2501032021-WF**	
Compiled by: (position+printed name+signature)	Happy Guo (File administrators)	
Tested by: (position+printed name+signature)	Jack Wang (Test Engineer)	
Approved by: (position+printed name+signature)	Ivan Xie (Manager)	

Product Name ..... :	EV AC Charger
Model/Type reference ..... :	HBE-AC48A01HW-U-BHSASD
List Model(s)..... :	HBE-ACXXA01HW-U-XXXXX
Trade Mark..... :	HBE
FCC ID..... :	**2BF82-BHSASD**
Applicant's name ..... :	**SHENZHEN HB ELECTRONIC CO LTD.**
Address of applicant ..... :	301F, 21Bl., ZHENGDAAN INDUSTRIAL PARK, 172 XIANGSHAN RD, BAOAN DISTRICT, Shenzhen, China
Test Firm..... :	**Shenzhen CTL Testing Technology Co., Ltd.**
Address of Test Firm ..... :	Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055
Test specification..... :	
Standard ..... :	**FCC Part 15.225:** Operation within the band 13.110–14.010MHz.
TRF Originator ..... :	Shenzhen CTL Testing Technology Co., Ltd.
Master TRF..... :	Dated 2011-01
Date of receipt of test item ..... :	Jan 14, 2025
Date of Test Date..... :	Jan 14, 2025-Feb 20, 2025
Data of Issue ..... :	Feb 27, 2025

TEST REPORT

Test Report No. :	CTL2501032021-WF	Feb 27, 2025 Date of issue

Equipment under Test	:	EV AC Charger
Sample No	:	CTL2501032021
Model /Type	:	HBE-AC48A01HW-U-BHSASD
Listed Models	:	HBE-ACXXA01HW-U-XXXXX
Applicant	:	**SHENZHEN HB ELECTRONIC CO LTD.**
Address	:	301F, 21Bl., ZHENGDAAN INDUSTRIAL PARK, 172 XIANGSHAN RD, BAOAN DISTRICT, Shenzhen, China
Manufacturer	:	**SHENZHEN HB ELECTRONIC CO LTD.**
Address	:	301F, 21Bl., ZHENGDAAN INDUSTRIAL PARK, 172 XIANGSHAN RD, BAOAN DISTRICT, Shenzhen, China

Test result	Pass *

* In the configuration tested, the EUT complied with the standards specified page 5.

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the issuing testing laboratory.

** Modified History **

Revisions	Description	Issued Data	Report No.	Remark
Version 1.0	Initial Test Report Release	2025-02-27	CTL2501032021-WF	Tracy Qi

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1. SUMMARY

1.1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.225: Operation within the band 13.110–14.010 MHz

ANSI C63.10:2013 : American National Standard for Testing Unlicensed Wireless Devices

1.2. Test Description

FCC PART 15 .225		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.215(c)	99% and 20dB Bandwidth	PASS
FCC Part 15.225(a) (b) (c)	In-band Emissions	PASS
FCC Part 15.225(d)/15.209	Out-of-band Emissions	PASS
FCC Part 15.225(e)	Frequency Stability Tolerance	PASS
FCC Part 15.203	Antenna Requirement	PASS

Remark: The measurement uncertainty is not included in the test result.

1.3. Test Facility

1.3.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.
Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 32/EN 55032 requirements.

1.3.2 Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L7497

Shenzhen CTL Testing Technology Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2017 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No. 4343.01

Shenzhen CTL Testing Technology Co., Ltd, EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

IC Registration No.: 9618B

CAB identifier: CN0041

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements with Registration No.: 9618B.

FCC-Registration No.: 399832

Designation No.: CN1216

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 399832.

1.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.
Hereafter the best measurement capability for CTL laboratory is reported:

Test	Measurement Uncertainty	Notes
Transmitter power conducted	±1.18 dB	(1)
Transmitter power Radiated	±2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	±1.6 dB	(1)
Occupied Bandwidth	±0.20ppm	(1)
Radiated Emission 0.009~30MHz	±4.03dB	(1)

Radiated Emission 30~1000MHz	±4.08dB	(1)
Radiated Emission Above 1GHz	±4.32dB	(1)
Conducted Disturbance0.15~30MHz	±3.20dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95%
(2) confidence level using a coverage factor of k=1.96.

2. GENERAL INFORMATION

2.1. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

2.2. General Description of EUT

Product Name:	EV AC Charger
Model/Type reference:	HBE-AC48A01HW-U-BHSASD
Power supply:	AC 240V/60Hz
RF ID	
Operation frequency:	13.56MHz
Modulation:	ASK
No. of Channel:	1
Antenna type:	PCB Antenna
Antenna Gain:	2dBi

Note1: For more details, please refer to the user's manual of the EUT.
Note2: Antenna gain provided by the applicant.

2.3. Equipments Used during the Test

Conducted Emission						
Test Equipment	Manufacturer	Model No.	Serial No.	Previous calibration	Last Cal.	Cal.Due
EMI Test Receiver	ROHDE & SCHWARZ	ESCI	1166.5950.03	2023/05/04	2024/04/30	2025/04/29
LISN	ROHDE & SCHWARZ	ESH2-Z5	860014/010	2023/05/04	2024/04/30	2025/04/29
Limitator	ROHDE & SCHWARZ	ESH3-Z2	100408	2023/05/04	2024/04/30	2025/04/29
Software:						
Name of Software:			Version:			
ES-K1			V1.71			

Radiated Emission						
Test Equipment	Manufacturer	Model No.	Serial No.	Previous calibration	Last Cal.	Cal.Due
Active Loop Antenna	Da Ze	ZN30900A	/	2021/05/13	2024/04/30	2025/04/29
Double cone logarithmic antenna	Schwarzbeck	VULB 9168	824	/	2023/02/13	2026/02/12
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	/	2024/11/25	2027/11/24
Amplifier	MRT-AP01M06	MRT	S-001	2023/05/04	2024/04/30	2025/04/29
Amplifier	Agilent	8449B	3008A02306	2023/05/04	2024/04/30	2025/04/29
Amplifier	Brief&Smart	LNA-4018	2104197	2023/05/05	2024/05/03	2025/05/02
EMI Test Receiver	ROHDE & SCHWARZ	ESCI	1166.5950.03	2023/05/04	2024/04/30	2025/04/29
Spectrum Analyzer	RS	FSP	1164.4391.38	2023/05/05	2024/05/03	2025/05/02
Software:						
Name of Software:			Version:			
EZ_EMC(Below 1GHz)			V1.1.4.2			
EZ_EMC(Above 1GHz)			V1.1.4.2			

RF Conducted						
Test Equipment	Manufacturer	Model No.	Serial No.	Previous calibration	Last Cal.	Cal.Due
Spectrum Analyzer	Keysight	N9020A	MY53420874	2023/05/04	2024/05/01	2025/04/30
Temperature/Humidity Meter	Ji Yu	MC501	/	2023/05/09	2024/05/04	2025/05/03
Software:						
Name of Software:			Version:			
TST-PASS			V2.0			

2.4. Description of Test Modes and Test Frequency

To be provided by the applicant, the prototype that can transmit (Duty Cycle more than 98%) the signal continuously when powered on and the prototype that can receive the signal after powered on.

Operation Frequency：

Frequency (MHz)
13.56

Power Parameters:

Test Software Version	Power on
Frequency	13.56MHz
RF ID	0

2.5. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: **2BF82-BHSASD** filing to comply with Section 15.225 of the FCC Part 15, Subpart C Rules.

2.6. Modifications

No modifications were implemented to meet testing criteria.

3. TEST CONDITIONS AND RESULTS

3.1. Conducted Emissions Test

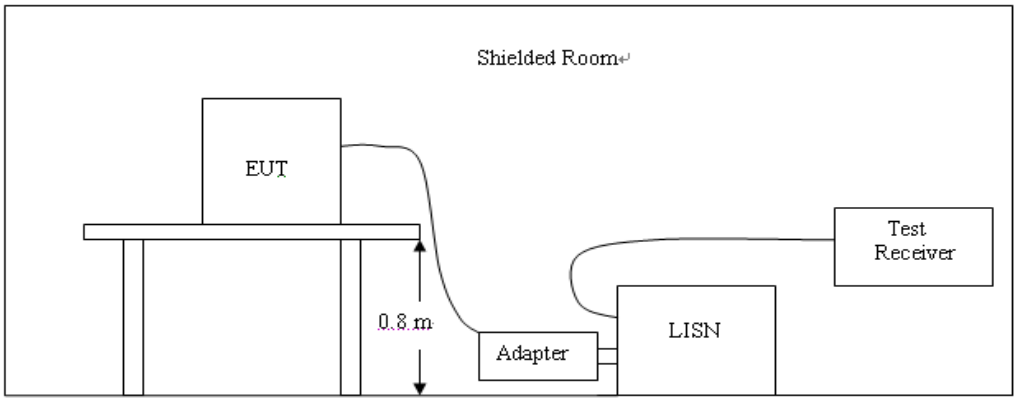
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency range (MHz)	Limit (dBuV)	
	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.

TEST CONFIGURATION



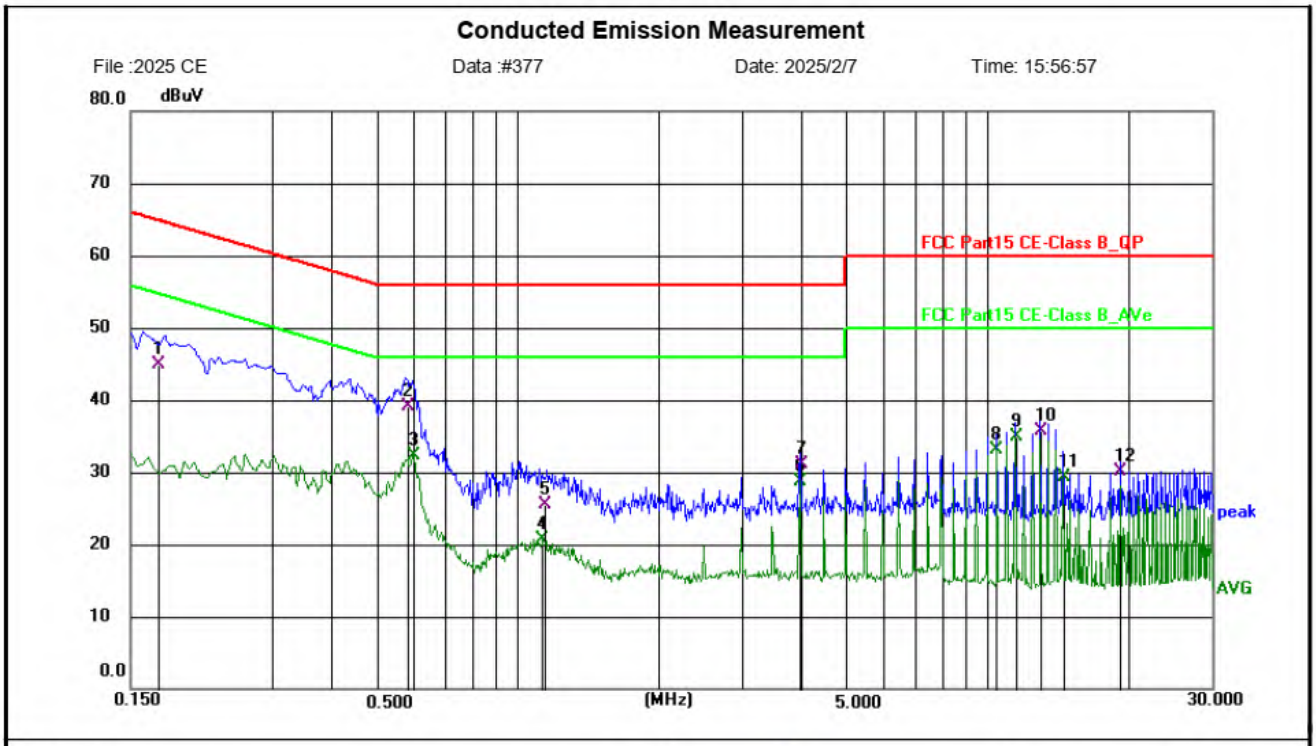
TEST PROCEDURE

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10:2013.
2. Support equipment, if needed, was placed as per ANSI C63.10:2013.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10:2013.
4. The adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.

TEST RESULTS

Note: The product is a dual live wire equipment, two live wires and one ground wire. The power supply is AC240V/60Hz.

LINE	L1



Site LAB
Limit: FCC Part15 CE-Class B_QP
EUT:
M/N:HBE-AC48A01HW-U-BHSASD
Mode: WORKING
Note:
Company name: SHENZHEN HB ELECTRONIC CO LTD.

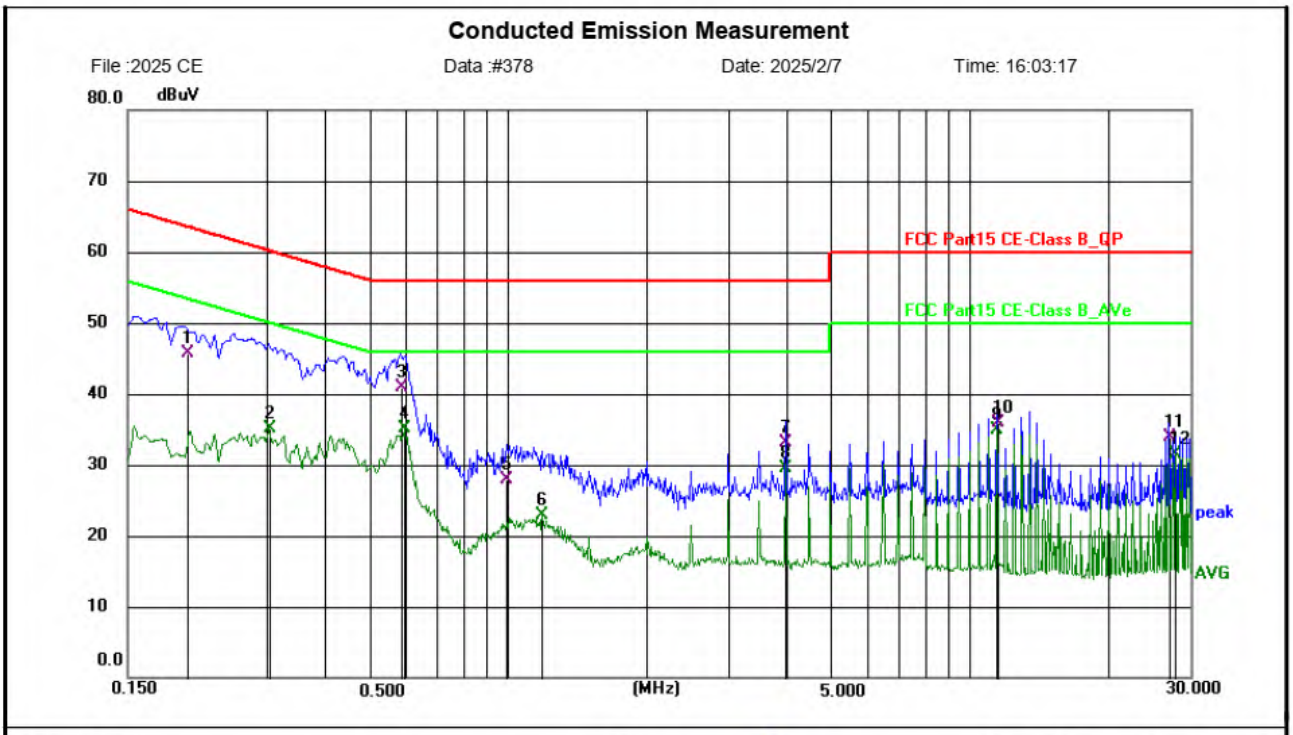
Phase: L1
Power: AC240V/60Hz

Temperature: 24(C)
Humidity: 50 %RH

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.1720	34.34	10.58	44.92	64.86	19.94	QP	P	
2	0.5810	28.79	10.27	39.06	56.00	16.94	QP	P	
3	0.6000	22.15	10.25	32.40	46.00	13.60	AVG	P	
4	1.1310	10.78	9.94	20.72	46.00	25.28	AVG	P	
5	1.1370	15.56	9.94	25.50	56.00	30.50	QP	P	
6	3.9885	18.72	9.98	28.70	46.00	17.30	AVG	P	
7	3.9940	21.20	9.98	31.18	56.00	24.82	QP	P	
8	10.4730	22.62	10.44	33.06	50.00	16.94	AVG	P	
9	11.4720	24.39	10.47	34.86	50.00	15.14	AVG	P	
10	12.9790	25.27	10.52	35.79	60.00	24.21	QP	P	
11	14.4645	18.74	10.55	29.29	50.00	20.71	AVG	P	
12	19.1420	19.39	10.67	30.06	60.00	29.94	QP	P	

Note: The product is a dual live wire equipment, two live wires and one ground wire. The power supply is AC240V/60Hz.

LINE	*L2*



Site LAB
Limit: FCC Part15 CE-Class B_QP
EUT:
M/N:HBE-AC48A01HW-U-BHSASD
Mode: WORKING
Note:
Company name: SHENZHEN HB ELECTRONIC CO LTD.

Phase: *L2*
Power: AC240V/60Hz

Temperature: 24(C)
Humidity: 50 %RH

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.2010	35.06	10.57	45.63	63.57	17.94	QP	P	
2	0.3030	24.57	10.50	35.07	50.16	15.09	AVG	P	
3	0.5870	30.64	10.28	40.92	56.00	15.08	QP	P	
4	0.5955	24.85	10.27	35.12	46.00	10.88	AVG	P	
5	0.9910	17.97	9.97	27.94	56.00	28.06	QP	P	
6	1.1895	13.02	9.96	22.98	46.00	23.02	AVG	P	
7	3.9960	23.05	10.05	33.10	56.00	22.90	QP	P	
8	3.9975	19.40	10.05	29.45	46.00	16.55	AVG	P	
9	11.4855	24.39	10.58	34.97	50.00	15.03	AVG	P	
10	11.4890	25.40	10.58	35.98	60.00	24.02	QP	P	
11	26.9730	22.93	10.97	33.90	60.00	26.10	QP	P	
12	27.9690	20.45	10.96	31.41	50.00	18.59	AVG	P	

3.2. Radiated Emission

Limit

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.

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.

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.

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.

Frequency (MHz)	Distance (Meters)	Radiated (dBuV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-13.110	3	69.54	30
13.110-13.410	3	80.50	106
13.410-13.553	3	90.47	334
13.553-13.567	3	124.00	15848
13.567-13.710	3	90.47	334
13.710-14.010	3	80.50	106
14.010-30.0	3	69.54	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

e Field strength of fundamental emissions limit and Mask limit:

The field strength of fundamental emissions shall not exceed 15848 microvolts/meter at 30 meters. The emissions limit in this paragraph is based on measurement instrumentation employing a QP detector.

Frequencies (MHz)	Field Strength (microvolts/meter)	Field Strength (dBμV/m) at 10m	Field Strength (dBμV/m) at 3m
13.553 ~ 13.567MHz	15848 at 30m	103.08 (QP)	124 (QP)

Mask Limit:

Frequency (MHz)	Limit (dBuV/m)	Distance (m)
1.705-13.110	69.5	3
13.110-13.410	80.5	3
13.410-13.553	90.5	3
13.553-13.567	124.0	3
13.567-13.710	90.5	3
13.710-14.010	80.5	3
14.010-30.000	69.5	3

Test Procedure

1. The EUT was placed on 80cm wooden desk above ground plane which on a turn table.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

4. Repeat above procedures until all frequency measurements have been completed.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL – AG

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

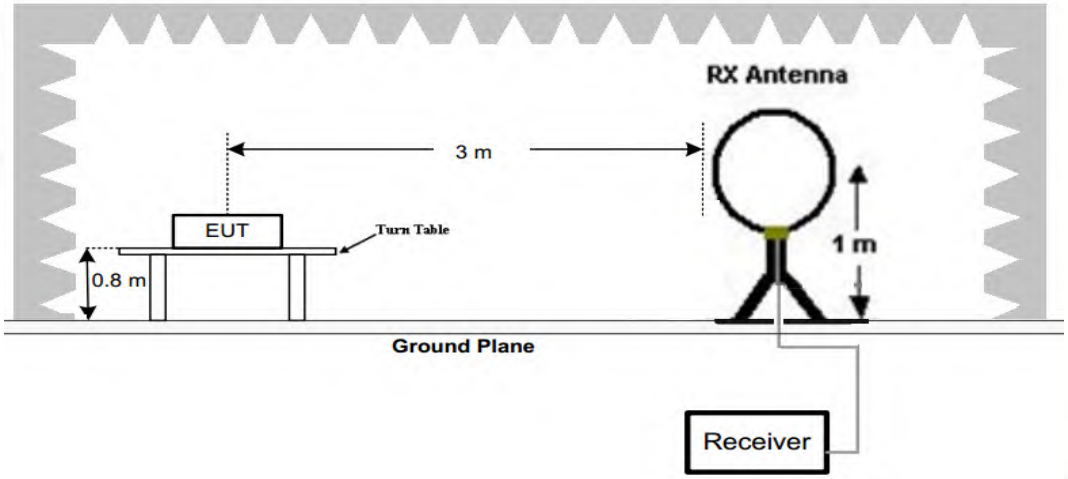
For example

Frequency (MHz)	FS (dBuV/m)	RA (dBuV/m)	AF (dB)	CL (dB)	AG (dB)	Transd (dB)
150.00	40	58.1	12.2	1.6	31.90	-18.1

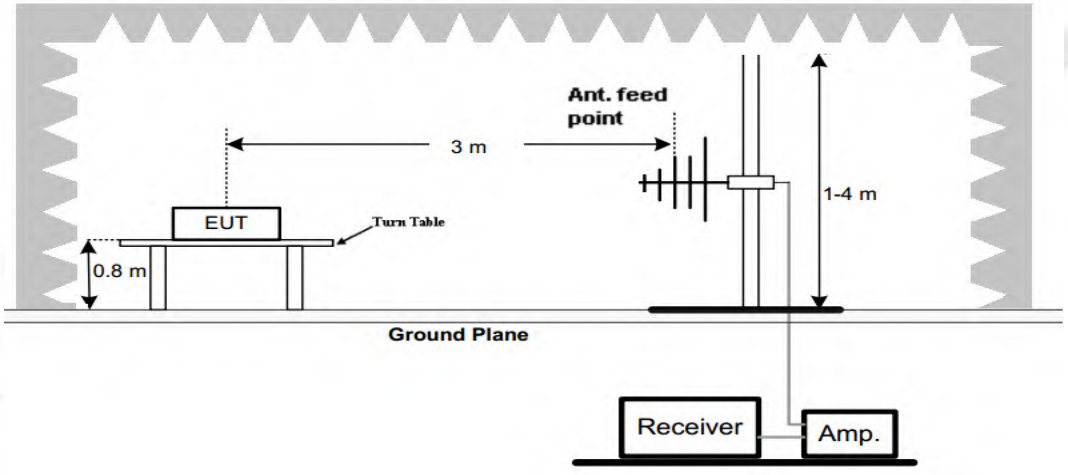
Transd=AF +CL-AG

Test Configuration

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



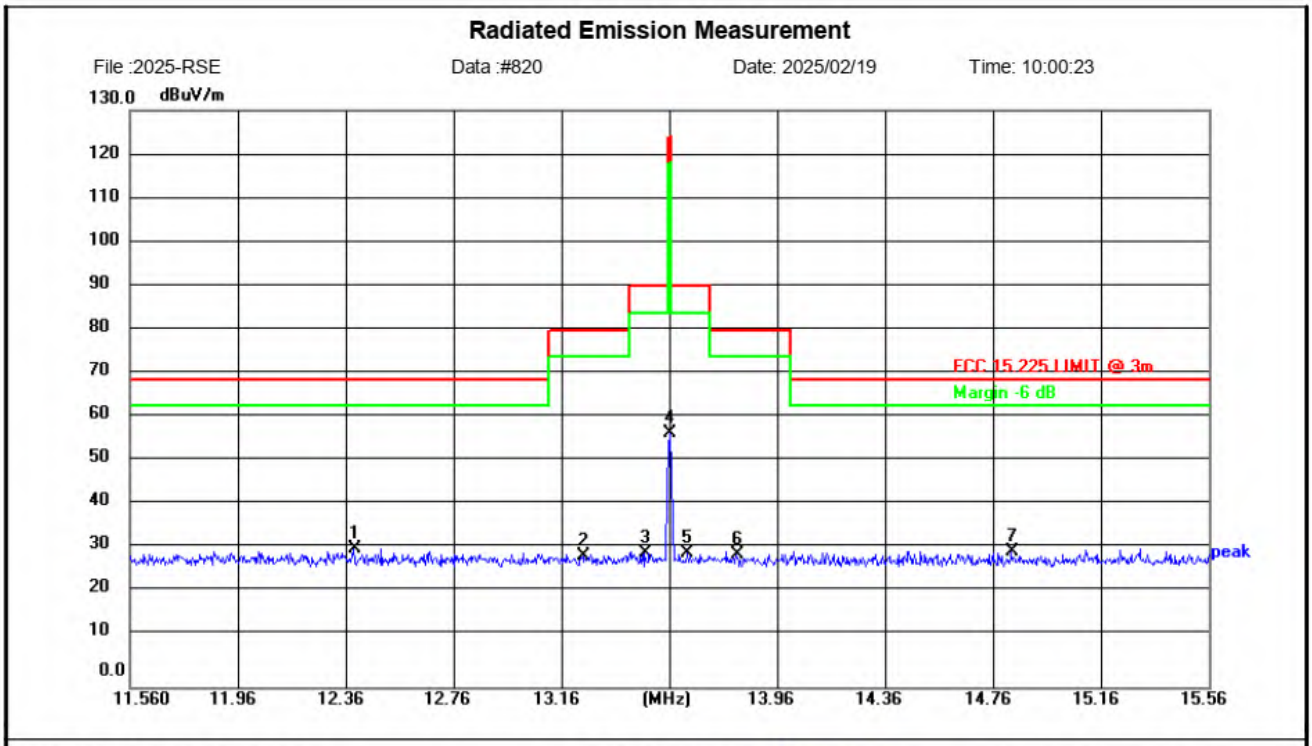
(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



Test Results

In-band Emissions

Polarization:	Horizontal



Site CTL 966 Chamber 1
Limit: FCC 15.225 LIMIT @ 3m
EUT:
M/N:HBE-AC48A01HW-U-BHSASD
Mode: WORKING
Note:
Company name:

Polarization: *Horizontal*
Power:
Distance: 3m

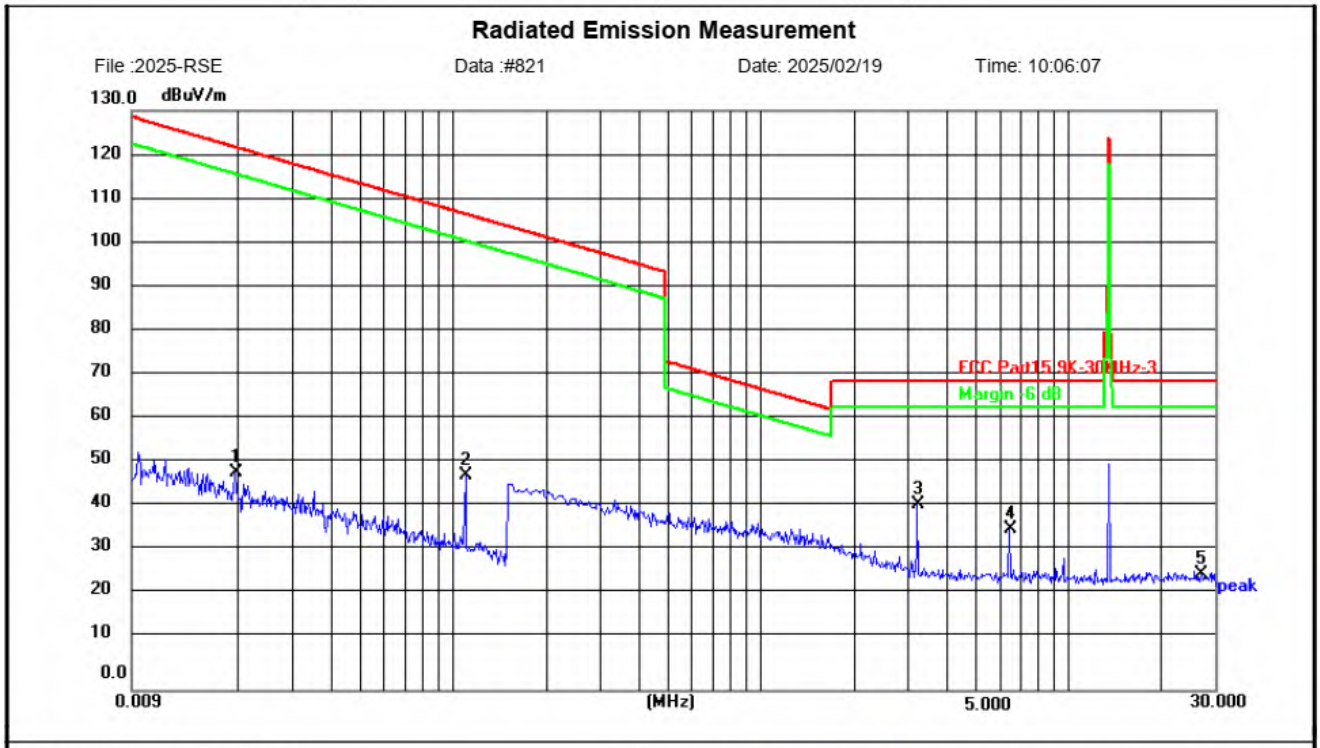
Temperature: 25(C)
Humidity: 50 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	12.3880	11.16	20.19	31.35	69.54	38.19	peak	100	1	P	
2	13.2400	9.55	20.18	29.73	80.50	50.77	peak	100	87	P	
3	13.4680	10.17	20.15	30.32	90.47	60.15	peak	100	352	P	
4	13.5600	37.33	20.14	57.47	124.00	66.53	peak	100	175	P	
5	13.6280	10.16	20.14	30.30	90.47	60.17	peak	100	234	P	
6	13.8080	10.07	20.12	30.19	80.50	50.31	peak	100	264	P	
7	14.8280	10.75	20.11	30.86	69.54	38.68	peak	100	264	P	

Out-of-band Emissions

For 9kHz-30MHz

Polarization:	Horizontal



Site CTL 966 Chamber 1
Limit: FCC Part15 9K-30MHz-3
EUT:
M/N:
Mode: HBE-AC48A01HW-U-BHSASD
Note:
Company name:SHENZHEN HB ELECTRONIC CO LTD.

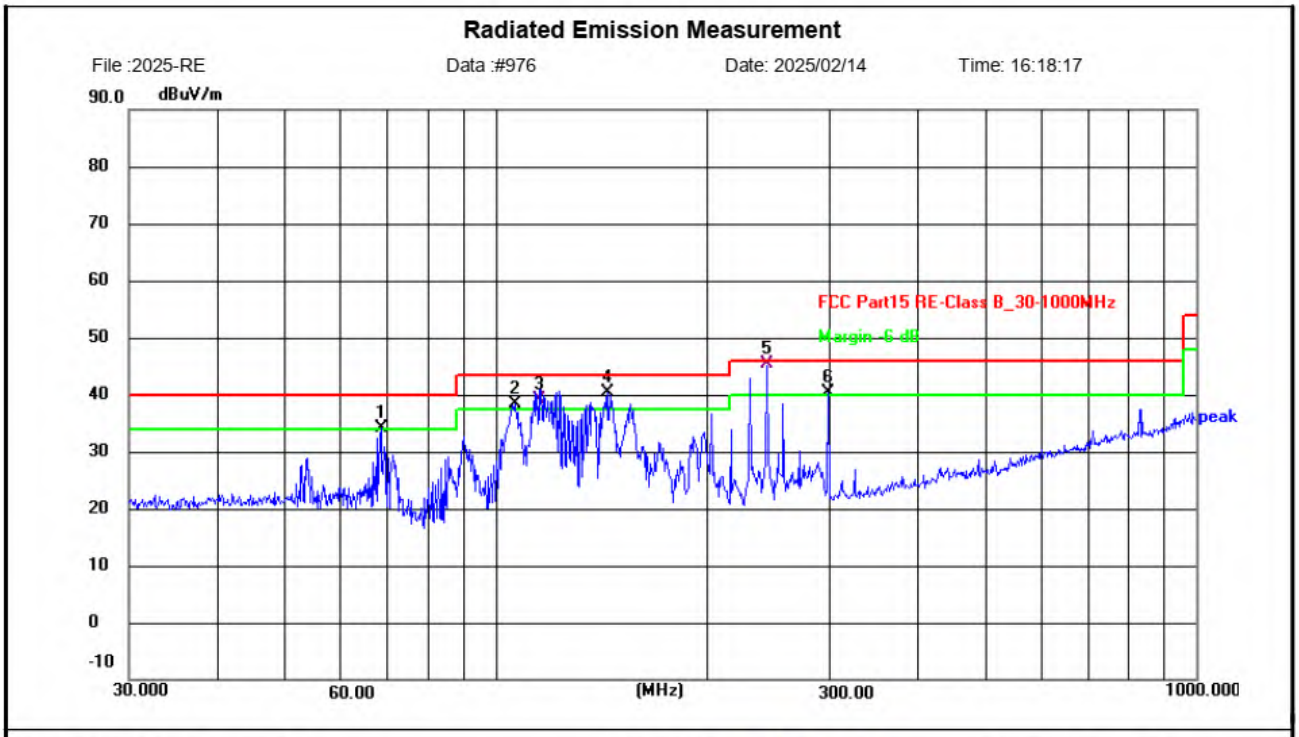
Polarization: *Horizontal*
Power:
Distance: 3m

Temperature: 25(C)
Humidity: 50 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	0.0195	29.01	19.79	48.80	121.80	73.00	peak	100	0	P	
2	0.1096	28.43	19.86	48.29	106.81	58.52	peak	100	0	P	
3	3.2325	22.19	19.69	41.88	69.54	27.66	peak	100	0	P	
4	6.4635	16.02	20.30	36.32	69.54	33.22	peak	100	0	P	
5	27.1200	5.47	20.82	26.29	69.50	43.21	peak	100	0	P	

For 30MHz-1GHz

Polarization:	Horizontal



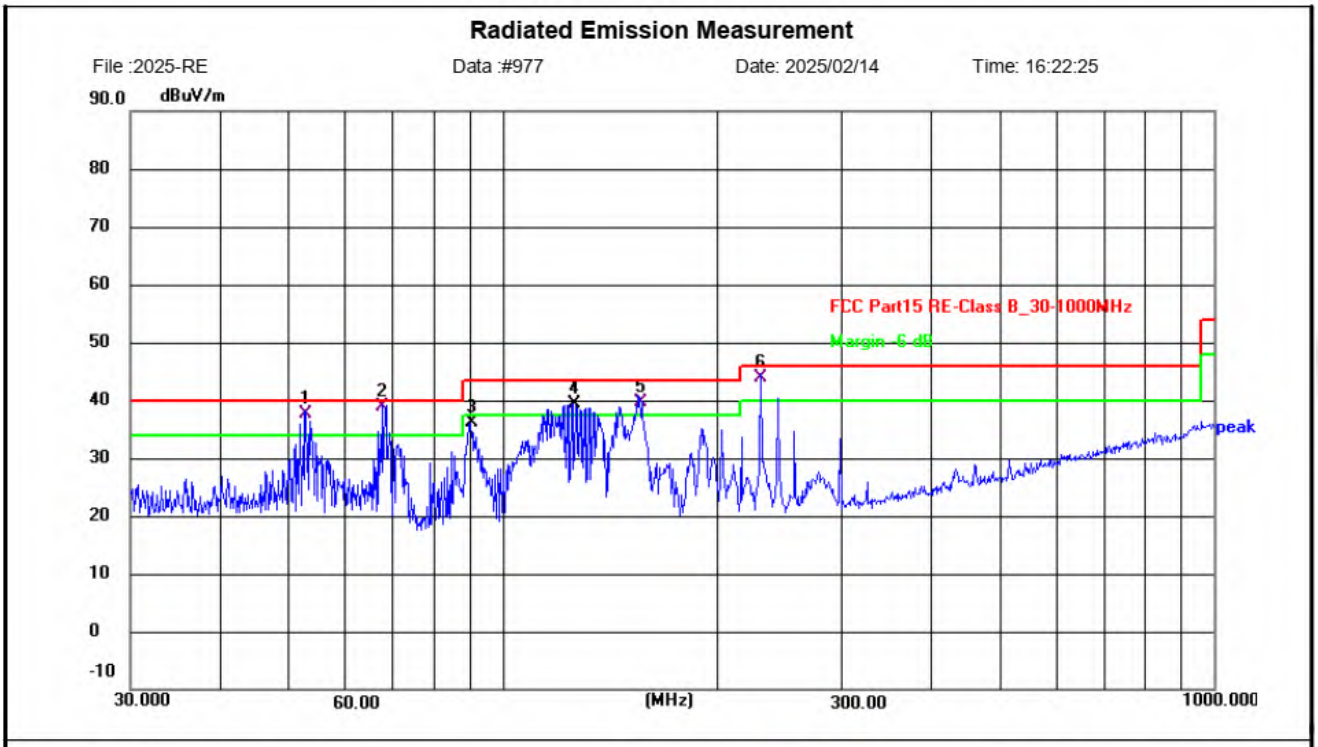
Site CTL 966 Chamber 1
Limit: FCC Part15 RE-Class B_30-1000MHz
EUT:
M/N:HBE-AC48A01HW-U-BHSASD
Mode: WORKING
Note:
Company name:

Polarization: *Horizontal*
Power: AC240V/50Hz
Distance: 3m

Temperature: 25(C)
Humidity: 50 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	68.6310	51.56	-17.38	34.18	40.00	5.82	peak	300	9	P	
2	106.7587	55.83	-17.55	38.28	43.50	5.22	peak	300	124	P	
3	115.1921	55.82	-16.61	39.21	43.50	4.29	QP	300	360	P	
4	144.8417	54.68	-14.41	40.27	43.50	3.23	peak	200	254	P	
5	244.0971	62.32	-16.98	45.34	46.00	0.66	QP	99	360	P	
6	298.2681	55.53	-15.22	40.31	46.00	5.69	peak	99	335	P	

Polarization:	Vertical



Site CTL 966 Chamber 1
Limit: FCC Part15 RE-Class B_30-1000MHz
EUT:
M/N: HBE-AC48A01HW-U-BHSASD
Mode: WORKING
Note:
Company name:

Polarization: *Vertical*
Power: AC240V/50Hz
Distance: 3m

Temperature: 25(C)
Humidity: 50 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	52.8950	53.42	-15.85	37.57	40.00	2.43	QP	99	360	P	
2	67.7001	56.25	-17.29	38.96	40.00	1.04	QP	99	360	P	
3	90.2205	55.28	-19.13	36.15	43.50	7.35	peak	100	217	P	
4	125.8864	55.16	-15.70	39.46	43.50	4.04	peak	100	235	P	
5	155.9794	53.82	-14.07	39.75	43.50	3.75	QP	99	360	P	
6	230.5218	61.81	-17.84	43.97	46.00	2.03	QP	99	360	P	

3.3. 20dB Bandwidth

Limit

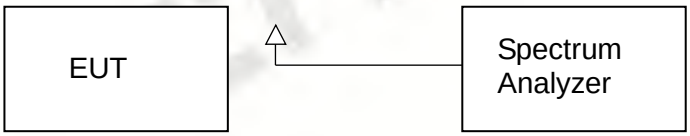
None, for reporting purposes only.

Test Procedure

The 20dB bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.

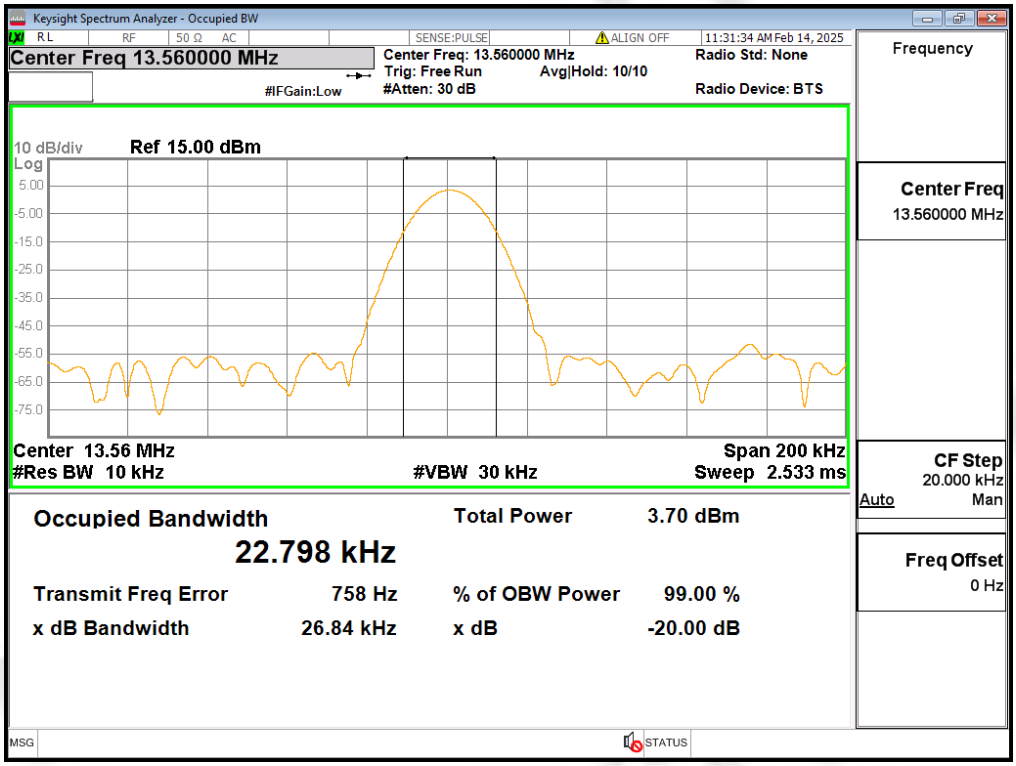
The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

Test Configuration



Test Results

Modulation	Frequency (MHz)	99% Bandwidth (kHz)	20dB bandwidth (kHz)	Result
ASK	13.560000	22.798	26.84	Pass

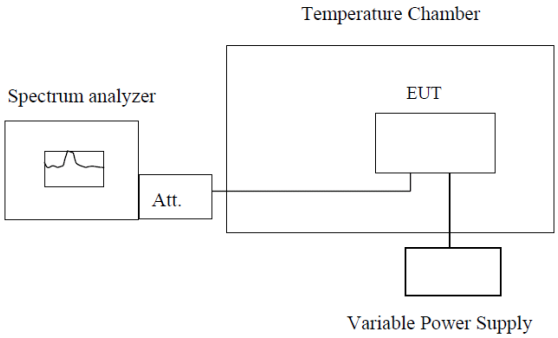


3.4. Frequency Stability

LIMIT

The frequency tolerance of the carrier signal shall be maintained within ±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.

TEST CONFIGURATION



Note : Measurement setup for testing on Antenna connector

TEST PROCEDURE

1. The equipment under test was connected to an external DC power supply and input rated voltage.
2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators.
3. The EUT was placed inside the temperature chamber.
4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20℃ operating frequency as reference frequency.
5. Turn EUT off and set the chamber temperature to –20℃. After the temperature stabilized for approximately 30 minutes recorded the frequency.
6. Repeat step measure with 10℃ increased per stage until the highest temperature of +50℃ reached.
7. Reduce the input voltage to specified extreme voltage variation (+/- 15%) or endpoint, record the maximum frequency change.

TEST RESULTS

Reference Frequency: 13.56MHz					
Voltage (V)	Temperature (℃)	Frequency (MHz)	Frequency Deviation (MHz)	Tolerance (ppm)	Limit (ppm)
240	+20	13.560018	0.000018	1.33	±100
	-20	13.560050	0.000050	3.69	±100
	-10	13.560068	0.000068	5.01	±100
	0	13.560000	0.000000	0.00	±100
	+10	13.560039	0.000039	2.88	±100
	+20	13.560090	0.000090	6.64	±100
	+25	13.560069	0.000069	5.09	±100
	+30	13.560094	0.000094	6.93	±100
	+40	13.560093	0.000093	6.86	±100
	+50	13.560093	0.000093	6.86	±100
276	+20	13.560085	0.000085	6.27	±100
204	+20	13.560039	0.000039	2.88	±100

3.5. Antenna Requirement

Standard Applicable

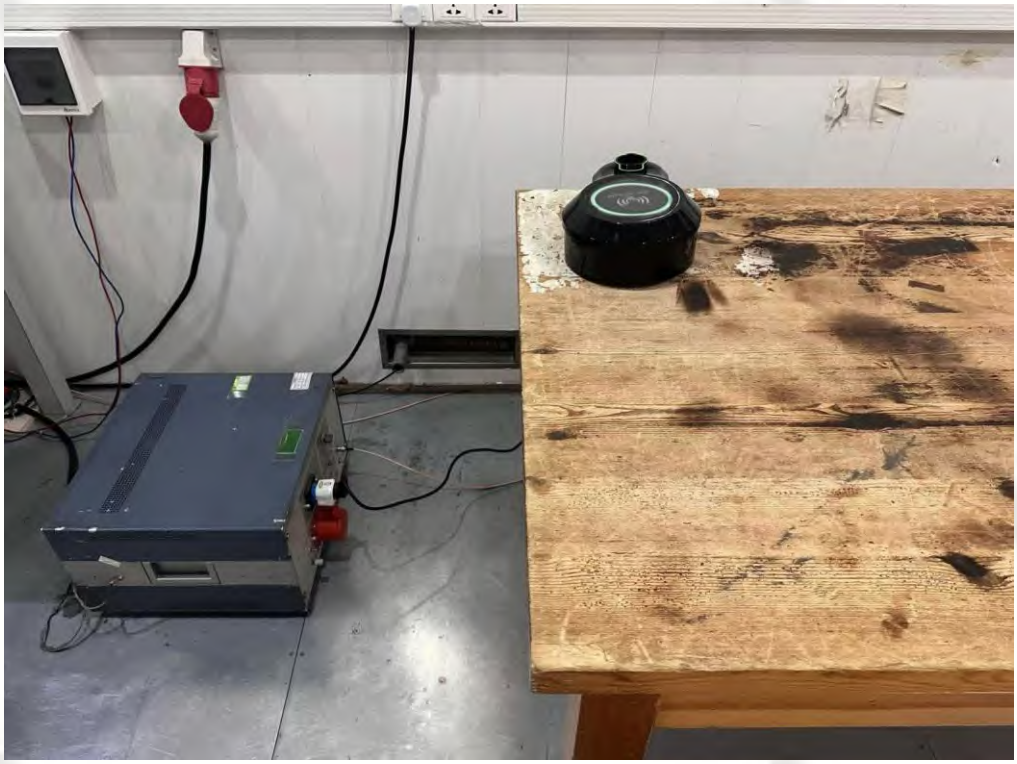
For intentional device, according to FCC 47 CFR Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited

Test Result:

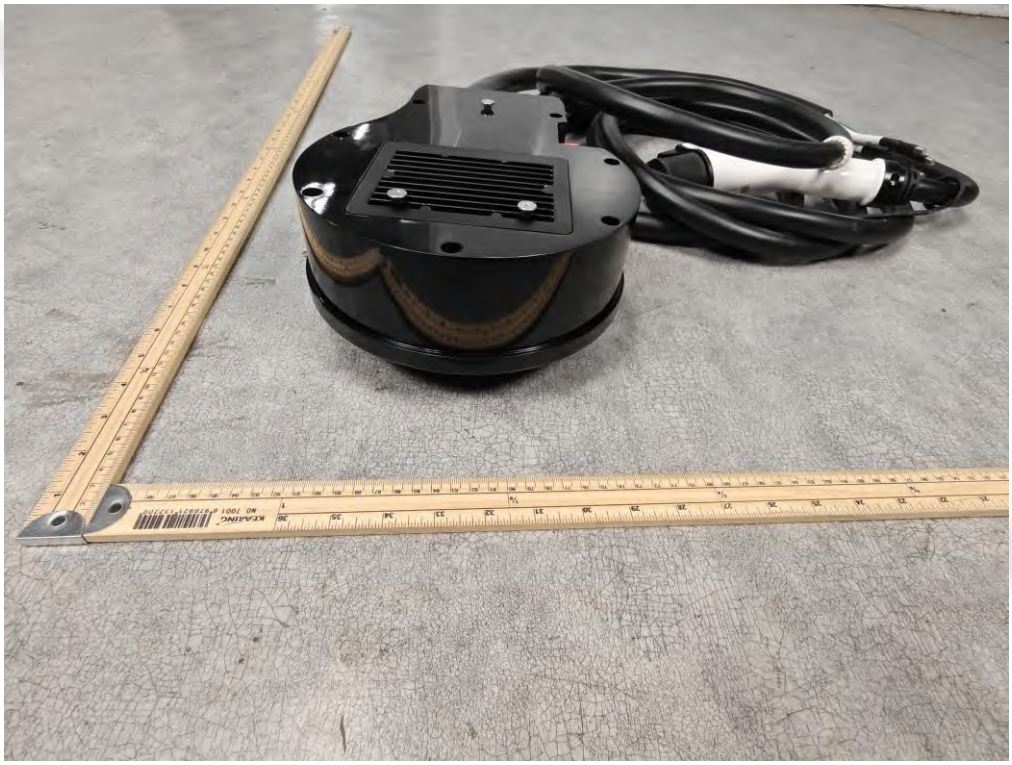
The antenna is a PCB Antenna and no consideration of replacement. See the chart below for details.

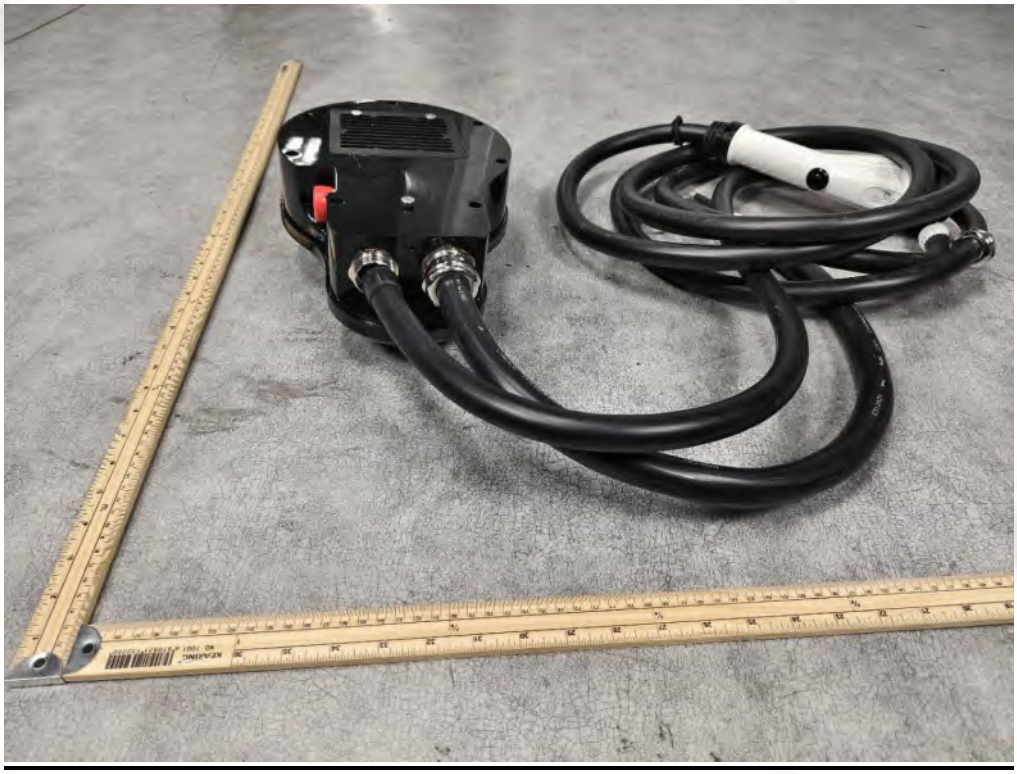
4. Test Setup Photos of the EUT



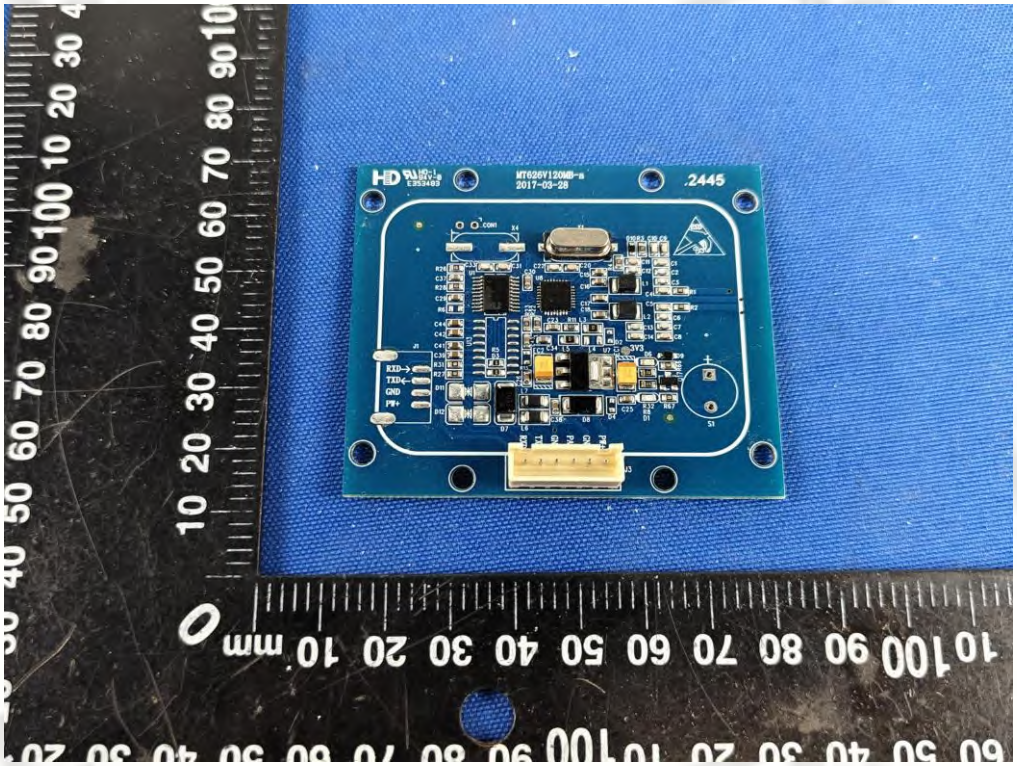
5. External and Internal Photos of the EUT

External Photos



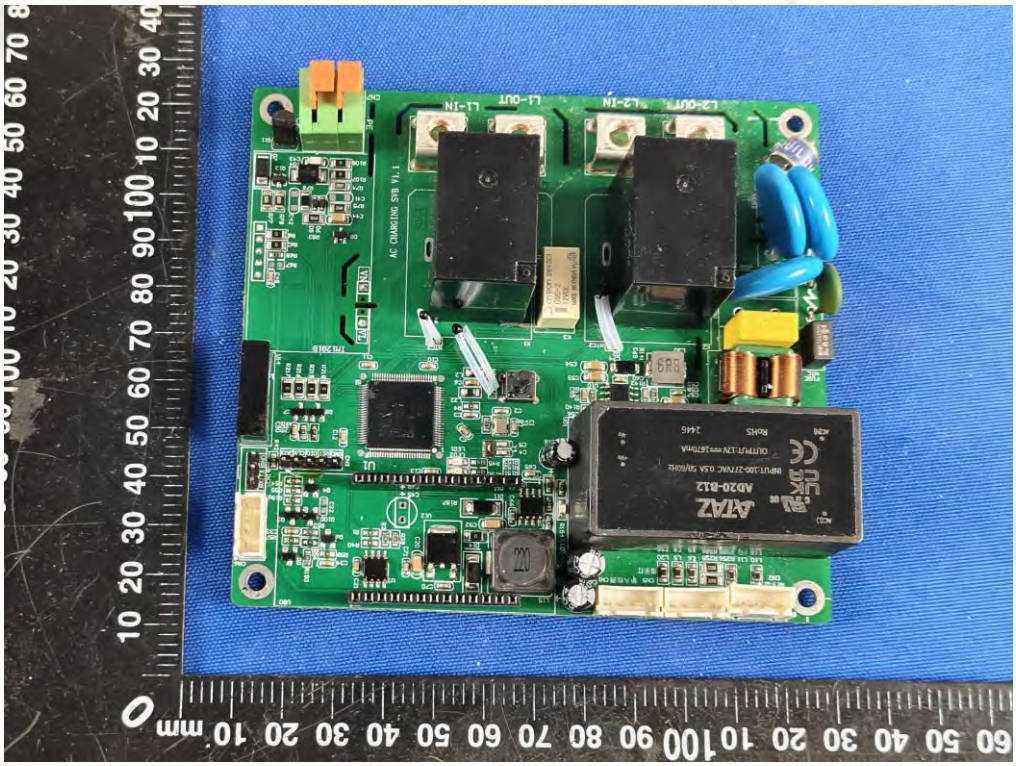


Internal Photos of EUT




RF ID Antenna


ATAZ
AD20-B12
L2-OUT
L2-IN
L1-OUT
L1-IN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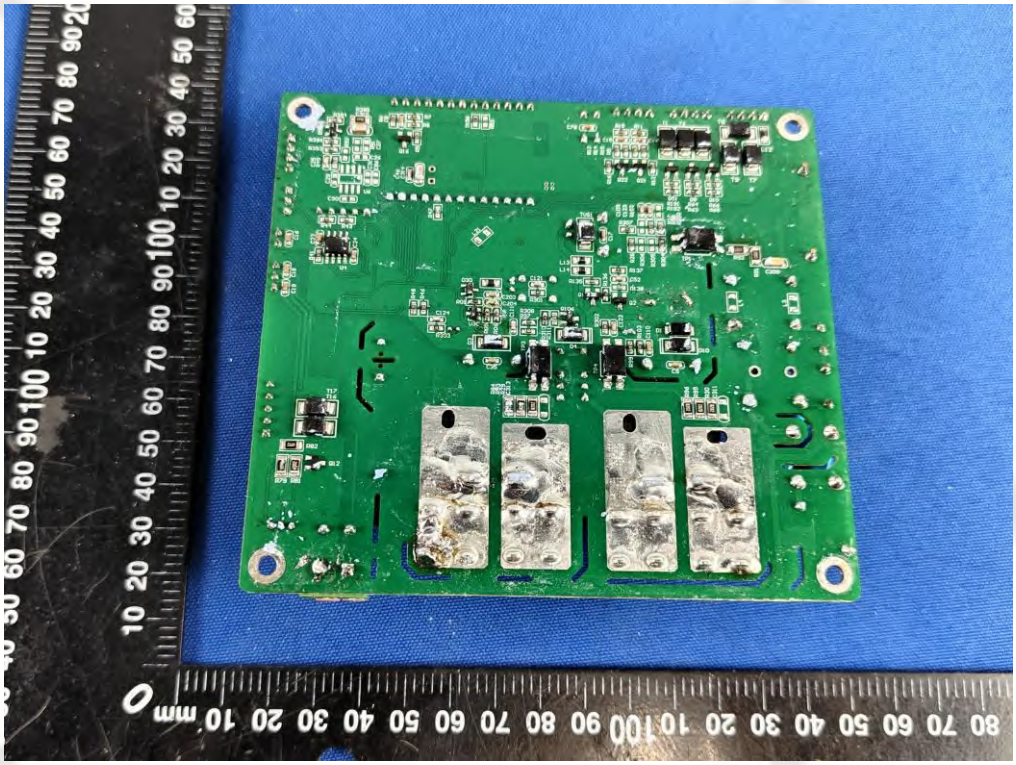
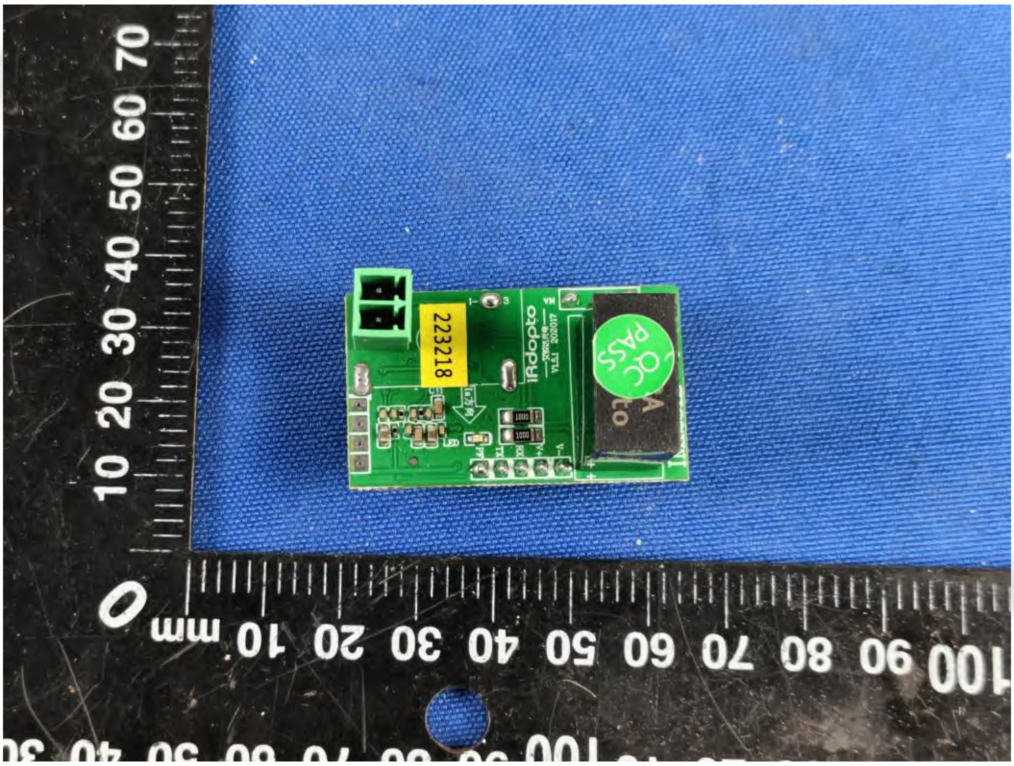
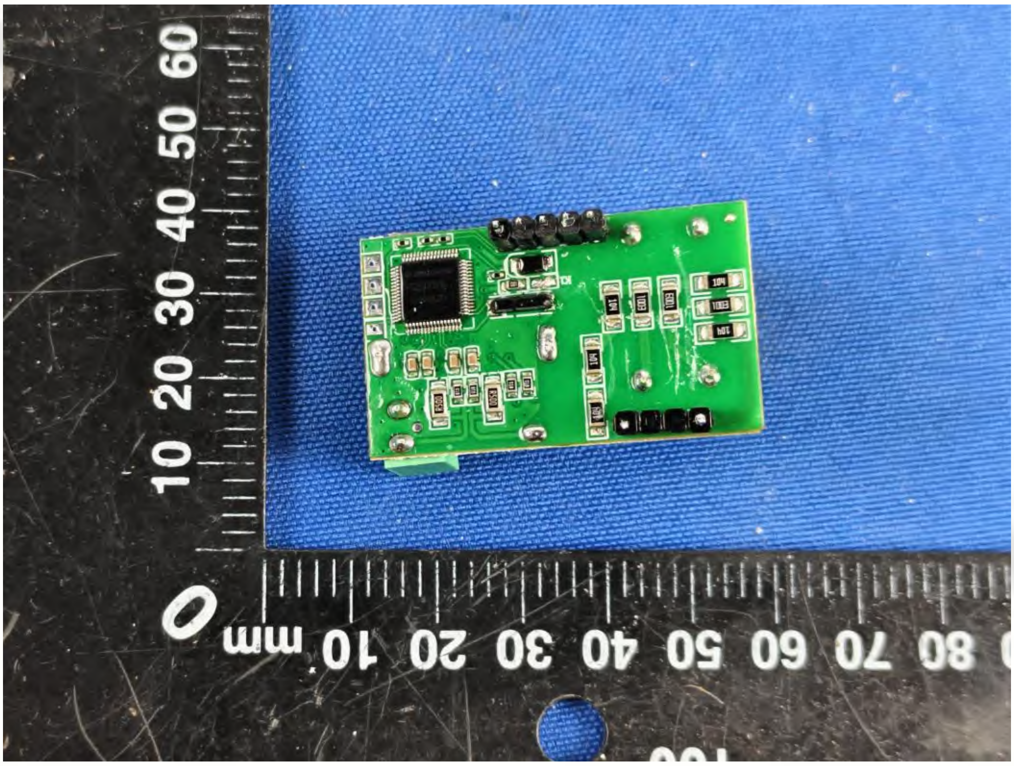
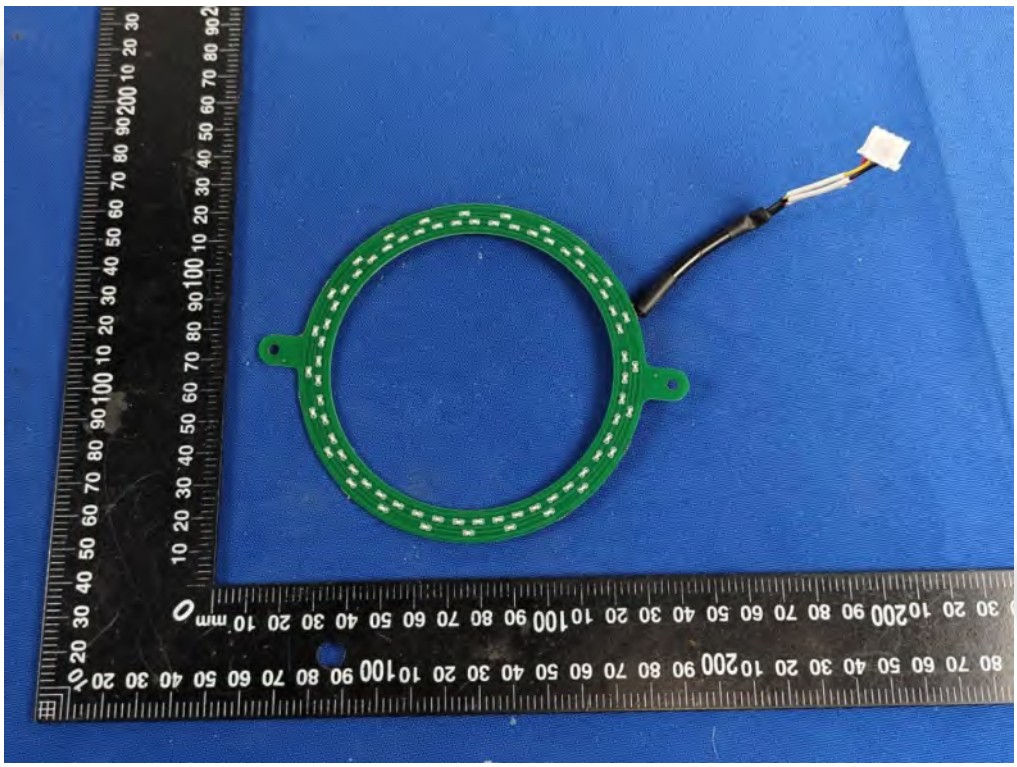
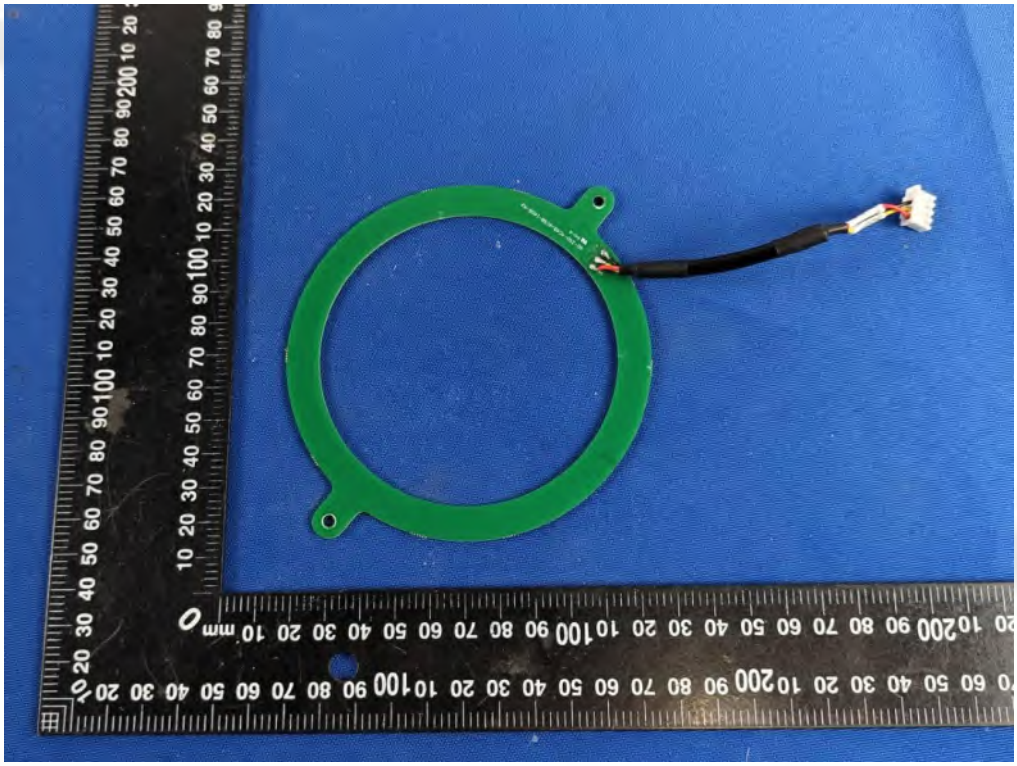
L1-IN
L1-OUT
L2-IN
L2-OUT
AD20-B12

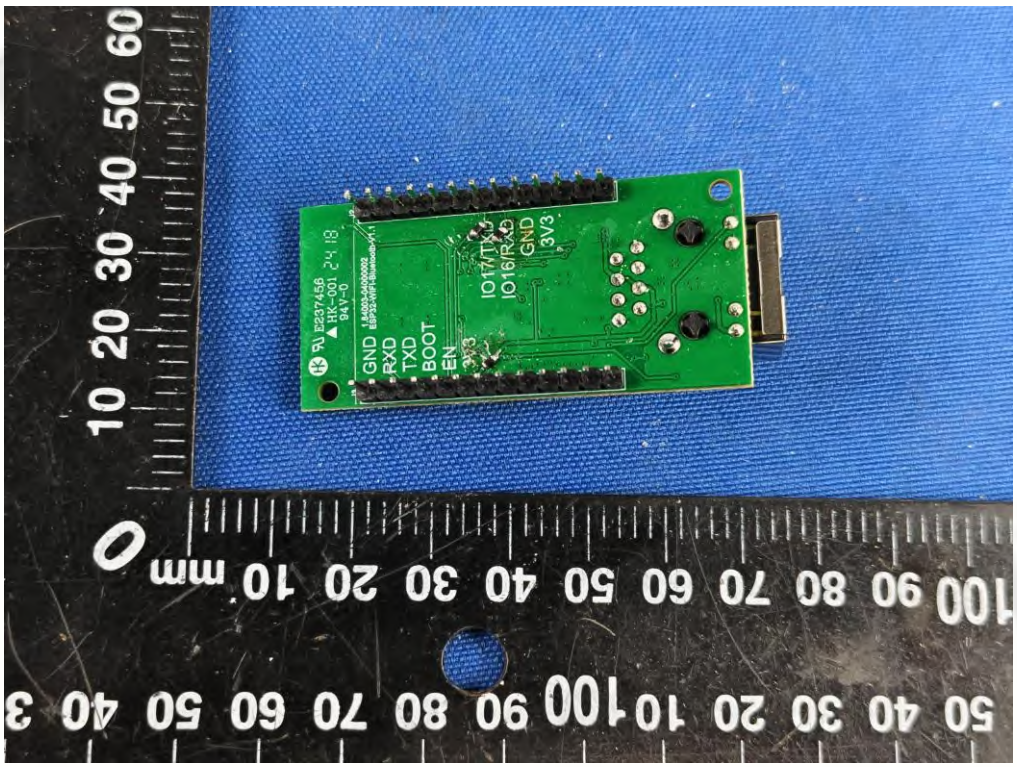


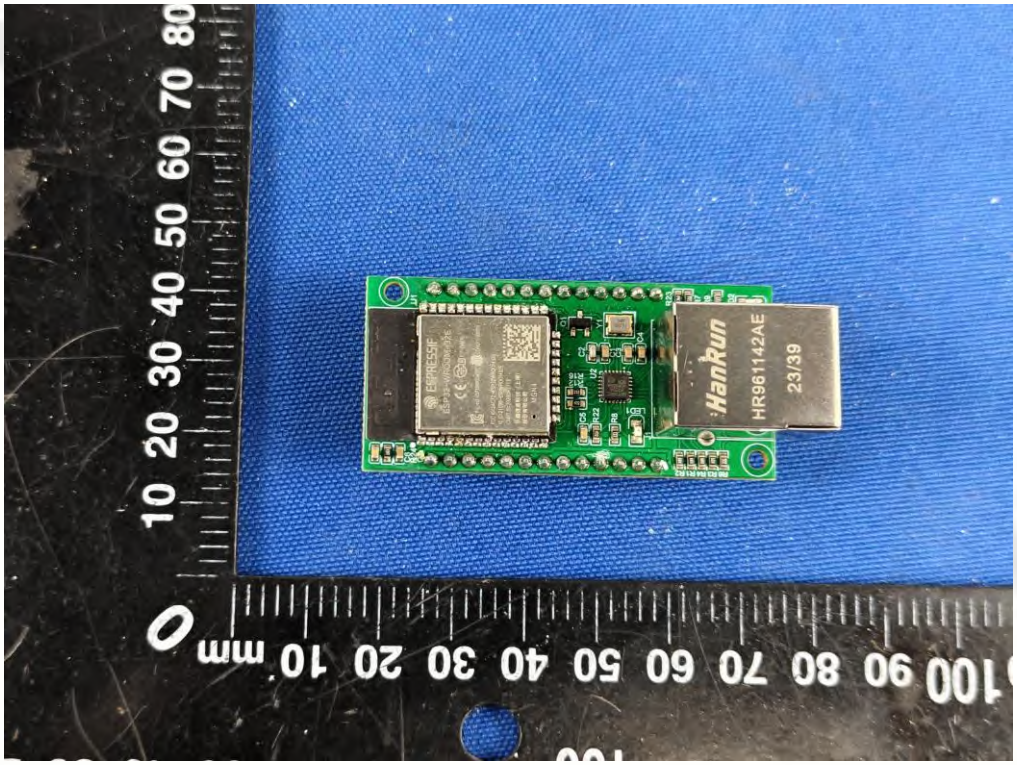

223218
iRdopto
QC PASS





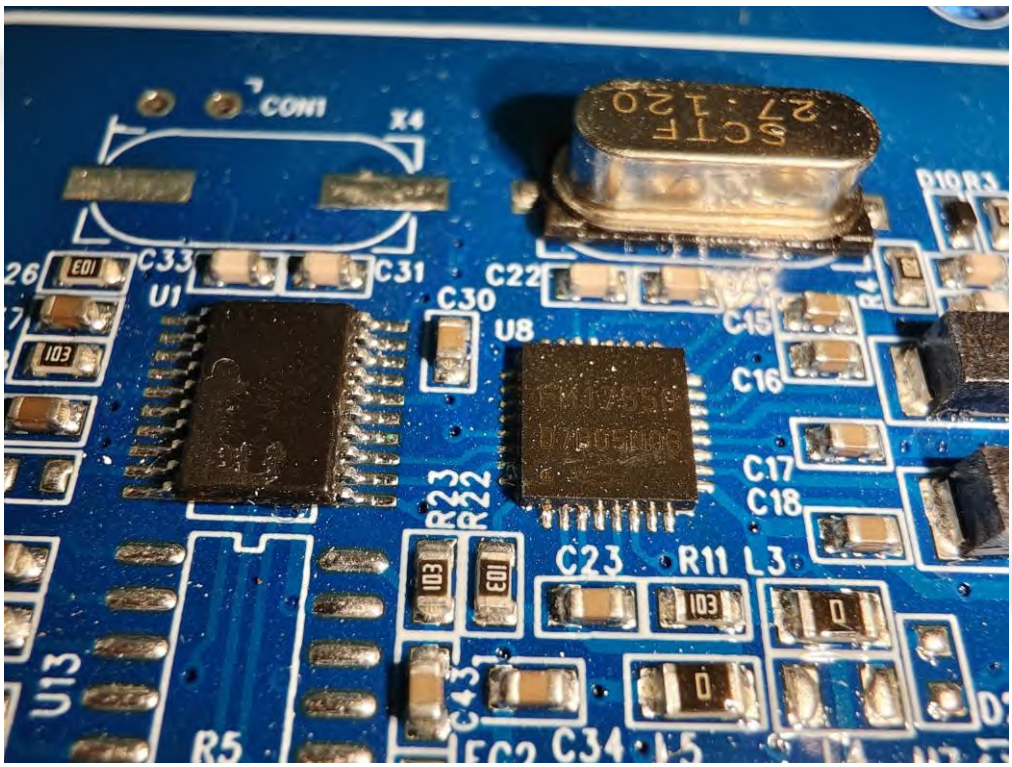



GND
RXD
TXD
BOOT
EN
3V3
IO17/TXD
IO16/RXD
GND
3V3


HanRun
HR961142AE
23/39


ESPRESSIF
ESP32-WROOM-32E
FCC ID:2AC7Z-ESP32WROOM32E
IC ID:21098-ESPWROOM32E
CMIIT ID:2020DP2713
乐鑫信息科技（上海）
股份有限公司
MGN4
U1
Q1


U1
GigaDevice
ARM
C13
C11
C10
R197
LED2
LED1
C3
R4
L2
C6



********** End of Report **********