FCC Test Report

Test Report
On Behalf of
Advanced Electronic Solutions Global Ltd.
For
Opyn Multi
Model No.: OPYN-MULTI-IP-IB

FCC ID: 2ALPX-OPYNMULTIIPIB

Prepared For:	**Advanced Electronic Solutions Global Ltd.** **Unit 4C, Kilcronagh Business Park Cookstown County Tyrone, United Kingdom**
Prepared By:	**Shenzhen HUAK Testing Technology Co., Ltd.** **1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China**
Date of Test:	**Sept. 26, 2024 ~ Oct. 30, 2024**
Date of Report:	**Oct. 30, 2024**
Report Number:	**HK2409265637-15E**

Test Result Certification

Applicant's Name.....:	Advanced Electronic Solutions Global Ltd.
Address .....:	Unit 4C, Kilcronagh Business Park Cookstown County Tyrone, United Kingdom
Manufacturer's Name .....:	Advanced Electronic Solutions Global Ltd.
Address .....:	Unit 4C, Kilcronagh Business Park Cookstown County Tyrone, United Kingdom

Product Description

Trade Mark .....:	AES
Product Name.....:	Opyn Multi
Model and/or Type Reference :	OPYN-MULTI-IP-IB
Standards .....:	FCC Rules and Regulations Part 15 Subpart C Section 15.225 ANSI C63.10: 2013

Date of Test.....:	
Date (s) of Performance of Tests .....:	**Sept. 26, 2024 ~ Oct. 30, 2024**
Date of Issue.....:	**Oct. 30, 2024**
Test Result.....:	**Pass**

Testing Engineer 

Len Liao

Technical Manager 

Sliver Wan

Authorized Signatory 

Jason Zhou

Table of Contents

1. Test Result Summary 5
1.1 Information of the Test Laboratory 5
1.2 Measurement Uncertainty 5
2. EUT Description 6
3. General Information 7
3.1 Test Environment and Mode 7
3.2 Description of Test Setup 8
3.3 Description of Support Units 9
4. Test Results and Measurement Data 10
4.1 Antenna Requirement 10
4.2 Conducted Emission 11
4.3 Radiated Emission Measurement 13
4.4 Occupied Bandwidth 20
4.5 Frequency Stability 22
5. Test Setup Photos of the EUT 24
6. Photos of the EUT 25

** Modified History **

Revision	Description	Issued Data	Remark
Revision 1.0	Initial Test Report Release	Oct. 30, 2024	Jason Zhou

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Add: 1-2F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

1. Test Result Summary

Requirement	CFR 47 Section	Result
Conduction Emission, 0.15MHz to 30MHz	§15.207	N/A
Radiation Emission	§15.225, §15.205, §15.209, §15.35	PASS
Occupied Bandwidth	§ 15.215	PASS
Antenna Requirement	§ 15.203	PASS
Frequency Stability	§ 15.225	PASS

Note:

1. PASS: Test item meets the requirement.

2. Fail: Test item does not meet the requirement.

3. N/A: Test case does not apply to the test object.

4. The test result judgment is decided by the limit of test standard.

1.1 Information of the Test Laboratory

Shenzhen HUAK Testing Technology Co., Ltd.
Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Testing Laboratory Authorization:

A2LA Accreditation Code is 4781.01.
FCC Designation Number is CN1229.
Canada IC CAB identifier is CN0045.
CNAS Registration Number is L9589.

1.2 Measurement Uncertainty

Measurement Uncertainty

Conducted Emission Expanded Uncertainty	=	2.71dB, k=2
Radiated emission expanded uncertainty(9kHz-30MHz)	=	3.90dB, k=2
Radiated emission expanded uncertainty(30MHz-1000MHz)	=	3.90dB, k=2
Radiated emission expanded uncertainty(Above 1GHz)	=	4.28dB, k=2

2. EUT Description

Equipment:	Opyn Multi
Model Name:	OPYN-MULTI-IP-IB
Series Models:	N/A
Model Difference:	N/A
FCC ID:	2ALPX-OPYNMULTIIPIB
Antenna Type:	PCB Antenna
Antenna Gain:	0dBi
Operation frequency:	13.56MHz
Modulation Type:	ASK
Power Source:	DC 12V From DC Power or DC 48V From POE Power
Power Rating:	DC 12V From DC Power or DC 48V From POE Power
Note: 1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual. 2. Antenna gain Refer to the antenna specifications. 3. The cable loss data is obtained from the supplier. 4. The test results in the report only apply to the tested sample.	

3. General Information

3.1 Test Environment and Mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Operation mode:	Keep the EUT in continuous transmitting with modulation
The sample was placed (0.8m below 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.	

Per-test mode.

We have verified the construction and function in typical operation, The EUT was placed on three different polar directions; i.e. X axis, Y axis, Z axis. which was shown in this test report and defined as follows:

Axis	X	Y	Z
Field Strength(dBuV/m)	93.29	96.51	94.18

Final Test Mode:

According to ANSI C63.10 standards, the test results are both the “worst case” and “worst setup”: Y axis (see the test setup photo)

3.2 Description of Test Setup

Operation of EUT during testing:

The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3mchamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. The worst case is X position

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Trade Mark	Model/Type No.	Specification	Remark
1	Opyn Multi	AES	OPYN-MULTI-IP-IB	N/A	EUT
2	Laptop	N/A	TP00096A	Input: DC 20V, 2.25A/3.25A	Peripheral

Note:

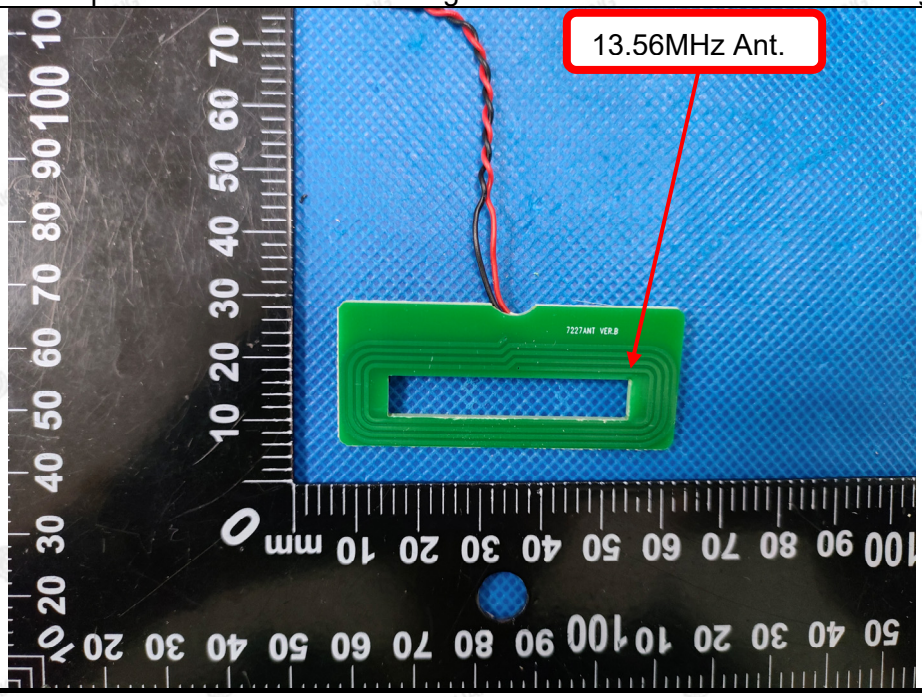
1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4. Test Results and Measurement Data

4.1 Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203
15.203 requirement: 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.	
E.U.T Antenna:	PCB Antenna
The antenna used in this product is a PCB Antenna, which permanently attached. It conforms to the standard requirements. The directional gains of antenna used for transmitting is 0dBi.	



4.2 Conducted Emission

4.2.1 Conducted Power Line Emission Limit

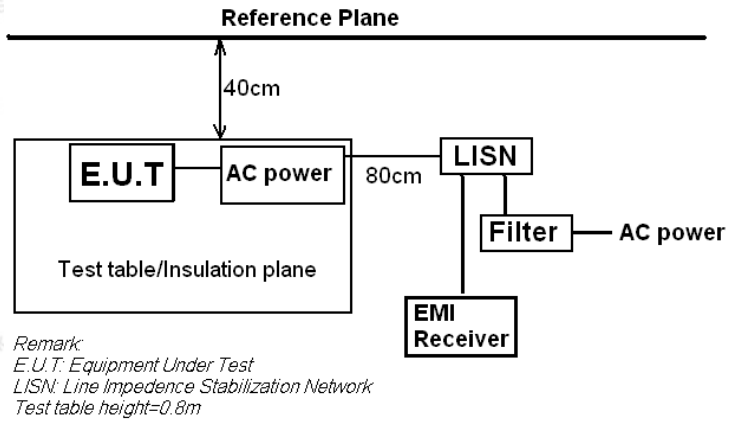
For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following.

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency.

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

4.2.2 Test Setup



Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m

4.2.3 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.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. If a EUT received DC power from the USB Port of Notebook PC, the PC's 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.

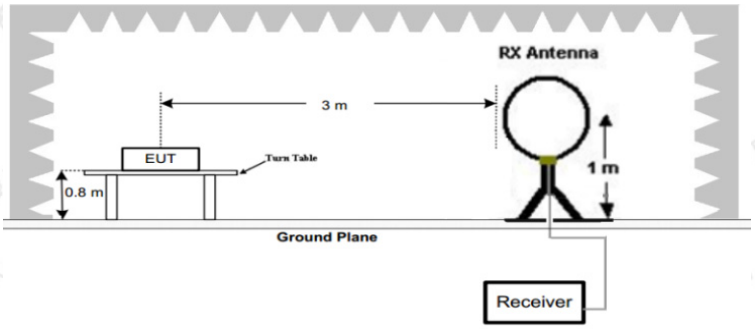
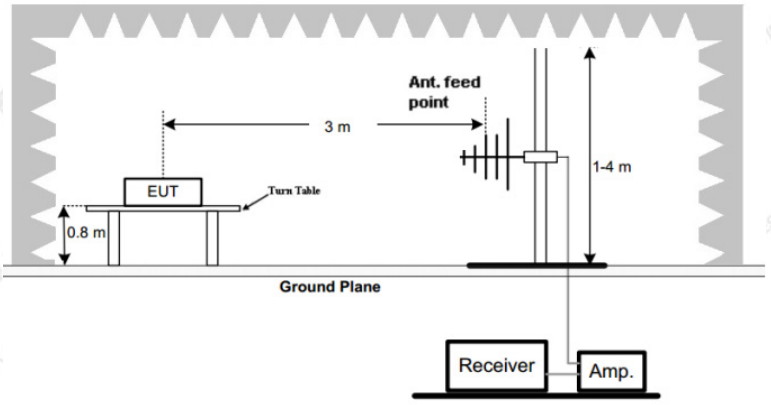
4.2.4 Test Result

Not applicable.
Note: EUT power supply by DC Power, so this test item not applicable.

4.3 Radiated Emission Measurement

4.3.1 Test Specification

<table>
<tr><td>Test Requirement:</td><td colspan="5">FCC Part15 C Section 15.225(a) and 15.209</td></tr>
<tr><td>Test Method:</td><td colspan="5">ANSI C63.10:2013</td></tr>
<tr><td>Frequency Range:</td><td colspan="5">9 kHz to 1 GHz</td></tr>
<tr><td>Measurement Distance:</td><td colspan="5">3 m</td></tr>
<tr><td>Antenna Polarization:</td><td colspan="5">Horizontal & Vertical</td></tr>
<tr><td>Receiver Setup:</td><td colspan="5"><table>
<tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td>9kHz- 150kHz</td><td>Quasi-peak</td><td>200Hz</td><td>1kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>150kHz-30MHz</td><td>Quasi-peak</td><td>9kHz</td><td>30kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120KHz</td><td>300KHz</td><td>Quasi-peak Value</td></tr>
</table></td></tr>
<tr><td></td><td colspan="5">1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber in below 1GHz. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</td></tr>
</table>

Test Setup:	For radiated emissions  30MHz to 1GHz 
Test Mode:	Transmitting Mode
Test Results:	PASS

4.3.2 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.

4.3.3 Frequencies in restricted band are complied to limit on Paragraph 15.209

Frequency Range (MHz)	Distance (m)	Field strength (dBμV/m)	Field strength (microvolts/meter)
0.009-0.490	300	20log 2400/F (kHz)	2400/F (kHz)
0.490-1.705	30	20log 24000/F (kHz)	24000/F (kHz)
1.705-30	30	20log 30	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

NOTE:
**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., S 15.231 and 15.241.

4.3.4 Test Instruments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1	L.I.S.N.	R&S	ENV216	HKE-002	2024/02/20	1 Year
2	L.I.S.N.	R&S	ENV216	HKE-059	2024/02/20	1 Year
3	EMI Test Receiver	R&S	ESR	HKE-005	2024/02/20	1 Year
4	Spectrum analyzer	Agilent	N9020A	HKE-025	2024/02/20	1 Year
5	Spectrum analyzer	R&S	FSV3044	HKE-126	2024/02/20	1 Year
6	Preamplifier	EMCI	EMC051845 S	HKE-006	2024/02/20	1 Year
7	Preamplifier	Schwarzbeck	BBV 9743	HKE-016	2024/02/20	1 Year
8	Preamplifier	A.H. Systems	SAS-574	HKE-182	2024/02/20	1 Year
9	6d Attenuator	Pasternack	6db	HKE-184	2024/02/20	1 Year
10	EMI Test Receiver	Rohde & Schwarz	ESR-7	HKE-010	2024/02/20	1 Year
11	Broadband Antenna	Schwarzbeck	VULB9168	HKE-167	2024/02/21	2 Year
12	Loop Antenna	COM-POWER	AL-130R	HKE-014	2024/02/21	2 Year
13	Horn Antenna	Schwarzbeck	9120D	HKE-013	2024/02/21	2 Year
14	EMI Test Software	Tonscend	JS32-CE 2.5.0.6	HKE-081	/	/
15	EMI Test Software	Tonscend	JS32-RE 5.0.0	HKE-082	/	/
16	RF Automatic control unit	Tonscend	JS0806-2	HKE-060	2024/02/20	1 Year
17	High pass filter unit	Tonscend	JS0806-F	HKE-055	2024/02/20	1 Year
18	Wireless Communication Test Set	R&S	CMU200	HKE-026	2024/02/20	1 Year
19	Wireless Communication Test Set	R&S	CMW500	HKE-027	2024/02/20	1 Year
20	High-low temperature chamber	Guangke	HT-80L	HKE-118	2024/06/10	1 Year
21	Temperature and humidity meter	Boyang	HTC-1	HKE-075	2024/06/10	1 Year
22	RF Test Software	Tonscend	JS1120-3 Version 3.3.23	HKE-083	/	/
23	10dB Attenuator	Schwarzbeck	VTSD9561F	HKE-153	2024/02/20	1 Year
24	RSE Test Software	Tonscend	JS36-RSE 5.0.0	HKE-184	/	/

4.3.5 Test Data

PASS

Note: this EUT was tested for all models and the worst case model (DC 12V) data was reported.

Field Strength of Fundamental

Frequency (MHz)	Reading (dBuV/m)	Correction Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polar (H/V)	Detector
13.21	45.30	15.82	61.12	80.51	-19.39	H	QP
13.21	44.57	15.82	60.39	80.51	-20.12	V	QP
13.85	47.11	15.82	62.93	80.51	-17.58	H	QP
13.85	47.10	15.82	62.92	80.51	-17.59	V	QP
13.56	82.83	12.33	95.16	124	-28.84	H	Peak
13.56	82.72	12.33	95.05	124	-28.95	V	Peak
13.45	52.50	15.82	68.32	90.47	-22.15	H	QP
13.45	50.32	15.82	66.14	90.47	-24.33	V	QP
13.62	48.91	15.82	64.73	90.47	-25.74	H	QP
13.62	45.27	15.82	61.09	90.47	-29.38	V	QP

Remark: Margin = Result - Limit

Result = Reading +Correction Factor

Correction Factor = Antenna Factor + Cable Factor

Spurious Emissions

Frequency Range (9 kHz-30MHz)

Frequency (MHz)	Level@3m (dBμV/m)	Limit@3m (dBμV/m)
--	--	--
--	--	--
--	--	--
--	--	--

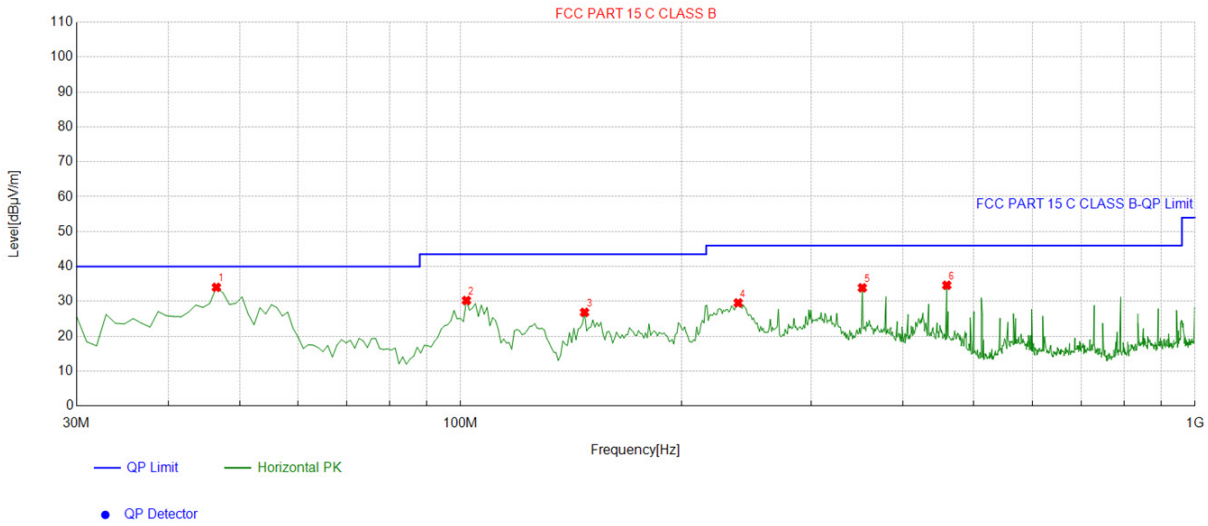
Note: *1. Emission Level=Reading+ Cable loss+ Antenna factor-Amp factor.*

2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement.

About 30MHz-1GHz

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Antenna polarity: H



Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	46.506507	-13.89	47.91	34.02	40.00	5.98	100	183	Horizontal
2	101.85185	-14.86	45.10	30.24	43.50	13.26	100	188	Horizontal
3	147.48748	-18.23	45.08	26.85	43.50	16.65	100	328	Horizontal
4	238.75875	-13.74	43.30	29.56	46.00	16.44	100	288	Horizontal
5	352.36236	-10.13	44.01	33.88	46.00	12.12	100	319	Horizontal
6	459.16916	-8.94	43.56	34.62	46.00	11.38	100	311	Horizontal

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

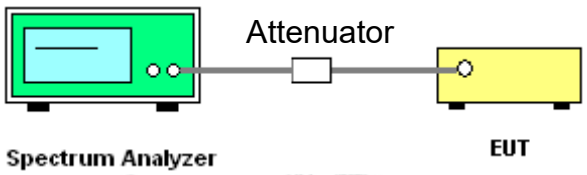
Antenna polarity: V

Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	38.738739	-14.30	43.89	29.59	40.00	10.41	100	293	Vertical
2	58.158158	-14.00	43.52	29.52	40.00	10.48	100	0	Vertical
3	142.63263	-18.41	46.24	27.83	43.50	15.67	100	265	Vertical
4	352.36236	-10.13	36.66	26.53	46.00	19.47	100	232	Vertical
5	459.16916	-8.94	40.69	31.75	46.00	14.25	100	18	Vertical
6	999.02902	-0.25	29.11	28.86	54.00	25.14	100	84	Vertical

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

4.4 Occupied Bandwidth

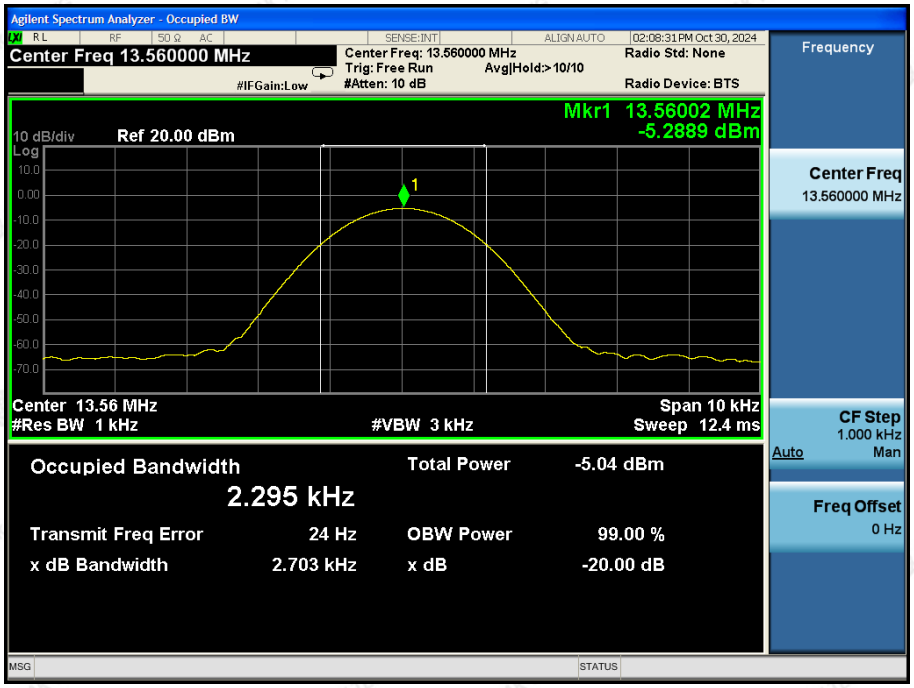
4.4.1 Test Specification

Test Requirement:	FCC Part15 C Section 15.215(c)
Test Method:	ANSI C63.10: 2013
Limit:	N/A
	1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Use the following spectrum analyzer settings for 20dB Bandwidth measurement. Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel; RBW≥ 1% of the 20 dB bandwidth; VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold. 4. Measure and record the results in the test report.
Test Setup:	
Test Mode:	Transmitting Mode
Test Results:	PASS

4.4.2 Test data

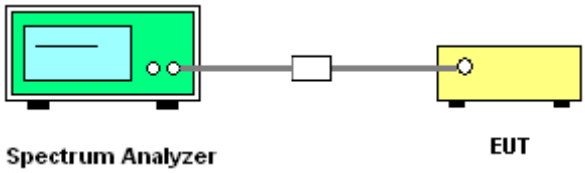
Test Channel (MHz)	20dB Occupy Bandwidth (kHz)	Limit (kHz)	Conclusion
13.56	2.703	N/A	PASS

Test plots as follows:



4.5 Frequency Stability

4.5.1 Test Specification

Test Requirement:	FCC Part15 C Section 15.225
Test Method:	ANSI C63.10: 2013
Limit:	+/-0.01%
	1. The equipment under test was connected to an external DC power supply and input rated voltage. 2. RF output was connected to a spectrum analyzer. 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 25℃ 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.
Test Setup:	
Test Mode:	Transmitting Mode
Test Results:	PASS

4.5.2 Test Data

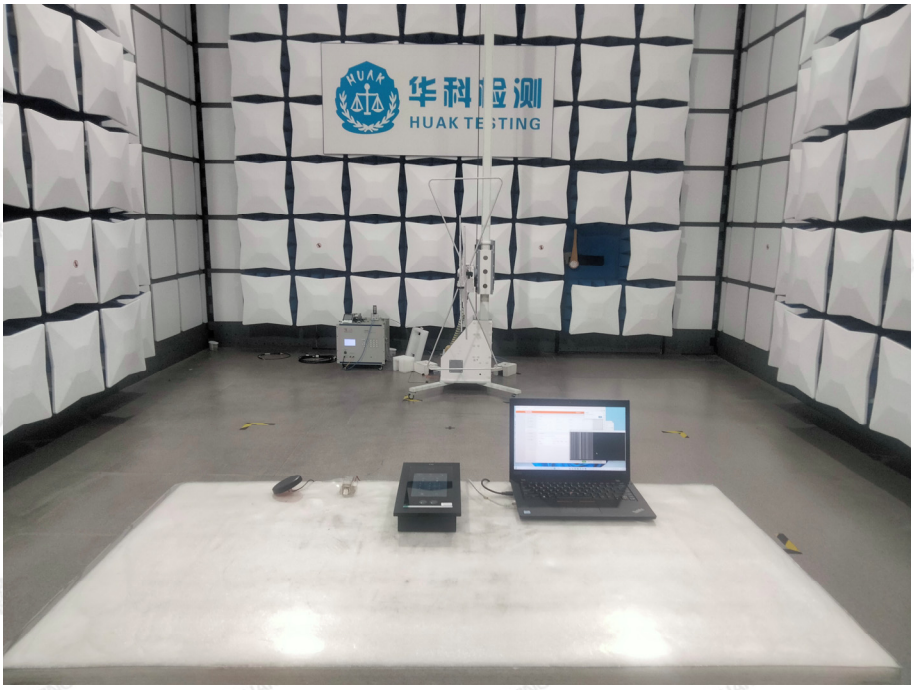
PASS

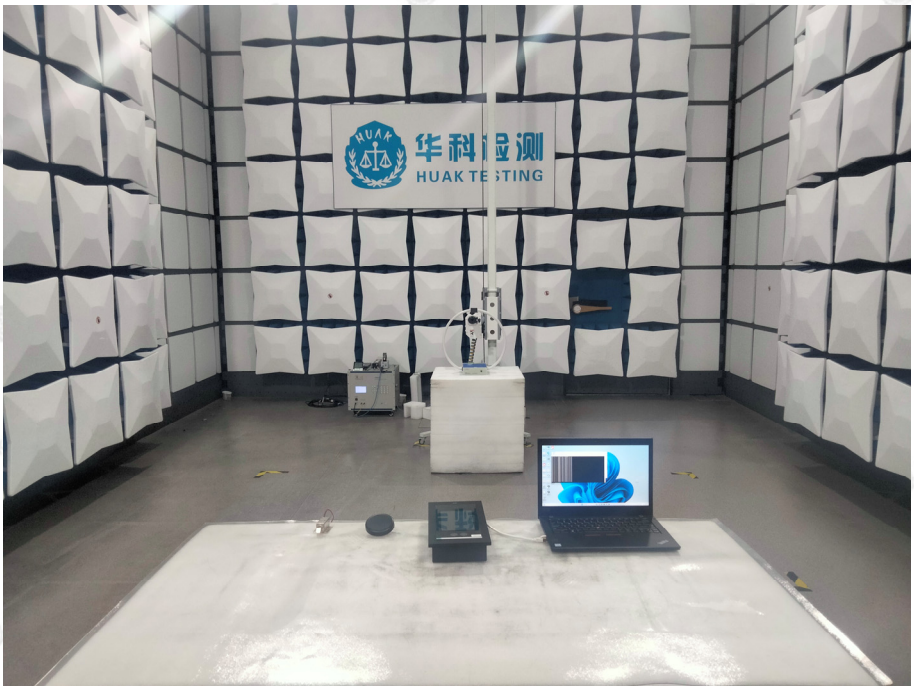
Note: this EUT was tested for all models and the worst case model (DC 12V) data was reported.

Voltage (Vdc)	Temperature (℃)	Frequency (MHz)	Deviation (%)	Limit (%)
12	-20	13.560261	0.00192%	+/-0.01%
12	-10	13.560169	0.00125%	
12	0	13.560281	0.00207%	
12	10	13.560213	0.00157%	
12	20	13.560146	0.00108%	
12	30	13.560077	0.00057%	
12	40	13.560211	0.00156%	
12	50	13.560261	0.00192%	
10.2	-20	13.560229	0.00169%	
10.2	-10	13.560055	0.00041%	
10.2	0	13.560187	0.00138%	
10.2	10	13.560316	0.00233%	
10.2	20	13.560066	0.00049%	
10.2	30	13.560401	0.00296%	
10.2	40	13.560271	0.00200%	
10.2	50	13.560336	0.00248%	
13.8	-20	13.560447	0.00330%	
13.8	-10	13.560199	0.00147%	
13.8	0	13.560209	0.00154%	
13.8	10	13.560346	0.00255%	
13.8	20	13.560305	0.00225%	
13.8	30	13.560218	0.00161%	
13.8	40	13.560194	0.00143%	
13.8	50	13.560249	0.00184%	

5. Test Setup Photos of the EUT

Radiated Emission





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6. Photos of the EUT

Reference to the report: ANNEX A of external photos and ANNEX B of internal photos.

---------End of test report---------

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