FCC & ISED TEST REPORT

Product Name:	CloudBoxx
Trade Mark:	N/A
Model No. / HVIN:	CB1020
Add. Model No. / HVIN:	N/A
Report Number:	2209291892EMC-1
Test Standards:	FCC 47 CFR Part 15 Subpart B ICES-003 Issue 7
Test Result:	PASS
Date of Issue:	September 11, 2023

Prepared for:

INVERS GmbH
Untere Industriestr. 20 D-57250 Netphen Germany

Prepared by:

Shenzhen UnionTrust Quality and Technology Co., Ltd.
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Approved by:	Kevin Liang Assistant Manager	Date:	September 11, 2023

Version

Version No.	Date	Description
V1.0	September 11, 2023	Original

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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	INVERS GmbH
Address of Applicant:	Untere Industriestr. 20 D-57250 Netphen Germany
Manufacturer 1:	EPS Electronic Products & Systems GmbH
Address of Manufacturer 1:	Eiserfelder Straße 316 57080 Siegen
Manufacturer 2:	Reichhardt Elektronik GmbH
Address of Manufacturer 2:	Eichelhainer Straße 18, 36369 Lautertal-Engelrod
Manufacturer 3:	duotec GmbH
Address of Manufacturer 3:	Humboldtstraße 8a D-58553 Halve

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	CloudBoxx
Model No. / HVIN:	CB1020
Add. Model No. / HVIN:	N/A
Trade Mark:	N/A
DUT Stage:	Production Unit
Rated Voltage:	☒ 7~56VDC
Classification of digital devices:	Class B
Highest Internal Frequency:	2480 MHz
Software Version:	2.15.1-0 (Provided by the customer)
Hardware Version:	CB1020 (Provided by the customer)
Sample Received Date:	November 15, 2022
Sample Tested Date:	December 19, 2022 to December 20, 2022
Remark: The above EUT's information was provided by customer. Please refer to the specifications or user's manual for more detailed description.	

1.2.2 Description of Accessories

None.

1.3 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Multicard Reader II	INVERS	N/A	76893	Applicant
Relay	Panasonic	CB1-M-12V	91206M	Applicant
Speaker	INVERS	N/A	Sample no: S20221116795-PJA02	Applicant
CAN Test - Tool	INVERS	CAN-PID-Lomo	13416	Applicant
RFID-Sticker	INVERS	5160254	N/A	Applicant
Smart Phone	NOKIA	TA-1361	N/A	UnionTrust
Storage Battery	Camel	58500 6-QWLZ-48	2602010594	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	CAN Cable	CAN	3 Meter	Applicant

1.4 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

1.5 TEST FACILITY

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

CNAS-Lab Code: L9069
The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01
Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories
CAB identifier: CN0032

FCC Accredited Lab.
Designation Number: CN1194
Test Firm Registration Number: 259480

1.6 DEVIATION FROM STANDARDS

None.

1.7 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.8 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.9 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9kHz-150kHz	±3.2 dB
2	Conducted emission 150kHz-30MHz	±2.7 dB
3	Radiated emission 9kHz-30MHz	± 4.7 dB
4	Radiated emission 30MHz-1GHz	± 4.6 dB
5	Radiated emission 1GHz-18GHz	± 4.4 dB
6	Radiated emission 18GHz-26GHz	± 4.6 dB
7	Radiated emission 26GHz-40GHz	± 4.6 dB

2. TEST SUMMARY

FCC 47 CFR Part 15 Subpart B Test Cases			
Test Item	**Test Requirement**	**Test Method**	**Result**
Conducted Emission	FCC 47 CFR Part 15.107 ICES-003 Issue 7 Section 3.2.1	ANSI C63.4-2014	N/A(NOTE2)
Radiated Emission	FCC 47 CFR Part 15.109 ICES-003 Issue 7 Section 3.2.2	ANSI C63.4-2014	PASS

Note:

1) N/A: In this whole report not applicable.
2) This EUT is powered by vehicle-mounted DC power supply.

3. EQUIPMENT LIST

Radiated Emission Test - 3M Chamber						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date**	**Cal. Due date**
☒	3m Chamber & Accessory Equipment	ETS-Lindgren	3m	Euroshiedpn-CT001270-1317	22-Jan-2021	21-Jan-2024
☐	Loop Antenna	ETS-Lindgren	6502	00202525	21-Nov-2022	20-Nov-2023
☒	Broadband Antenna	ETS-Lindgren	3142E	00201566	13-Dec-2022	12-Dec-2023
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	13-Dec-2022	12-Dec-2023
☒	Pre-amplifier	HP	8447F	2805A02960	1-Nov-2022	31-Oct-2023
☒	Double-Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	00164202	11-Nov-2021	10-Nov-2023
☒	Pre-amplifier	ETS-Lindgren	118385	00201874	1-Nov-2022	31-Oct-2023
☒	Double-Ridged Waveguide Horn Antenna	ETS-Lindgren	3116C	00200180	17-Apr-2022	16-Apr-2024
☒	Pre-amplifier	ETS-Lindgren	00118384	00202652	21-Nov-2022	20-Nov-2023
☒	Receiver	ROHDE & SCHWARZ	ESIB26	100114	3-Nov-2022	2-Nov-2023
☒	Multi device Controller	ETS-Lindgren	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Environment Parameter	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage	Relative Humidity (%)
NT/NV	+15 to +35	12VDC / 24VDC	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment and Test Sample

Test Item	Temp. (°C)	Relative Humidity (%)	Pressure (kPa)	Sample No.	Tested by
Radiated Emission	17.3	30.4	100.8	S20221116795-ZJA08/10	Yana Zeng

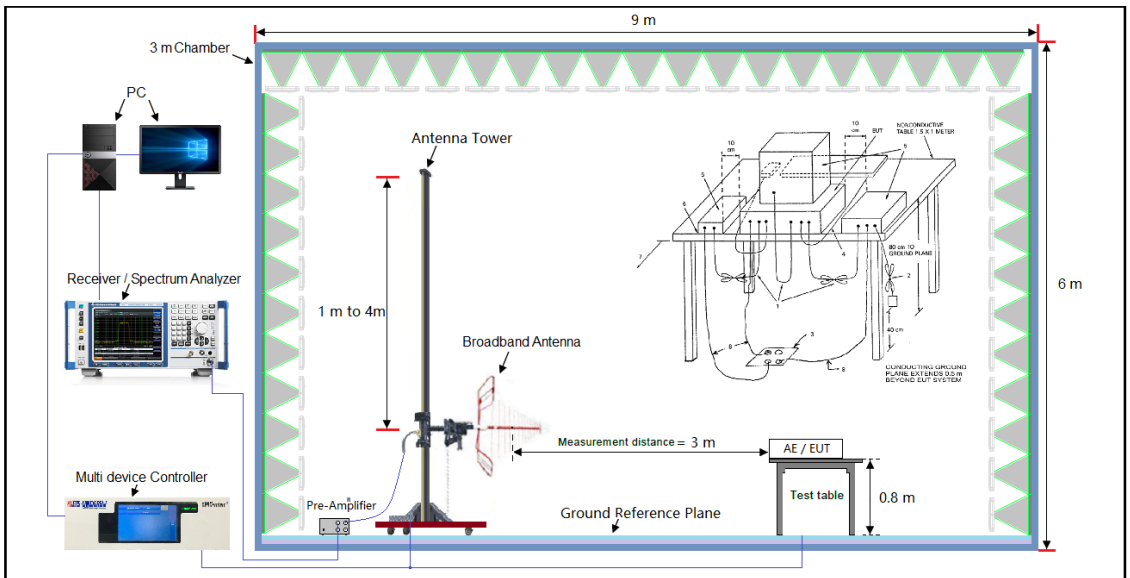
4.2 TEST MODES

Test Item	EMI Test Modes
Radiated Emission	TM1: GSM 850 Idle + Bluetooth Link to Smartphone + 2.4GHz Wi-Fi Receiver Scanning + RFID ON + GNSS RX + Data Transmission + Speaker + DC 12V Power TM2: LTE Cat M Band 2 Idle + Bluetooth Link to Smartphone + 2.4GHz Wi-Fi Receiver Scanning + RFID ON + GNSS RX + Data Transmission + Speaker + DC 12V Power TM3: LTE Cat M Band 12 Idle + Bluetooth Link to Smartphone + 2.4GHz Wi-Fi Receiver Scanning + RFID ON + GNSS RX + Data Transmission + Speaker + DC 12V Power **TM4: LTE Cat M Band 66 Idle + Bluetooth Link to Smartphone + 2.4GHz Wi-Fi Receiver Scanning + RFID ON + GNSS RX + Data Transmission + Speaker + DC 12V Power** **TM5: Worst case from TM1~4 + DC 24V Power**
Conducted Emission	N/A.
Remark: The above test modes in boldface were the worst cases, only the test data of these modes were reported.	

4.3 TEST SETUP

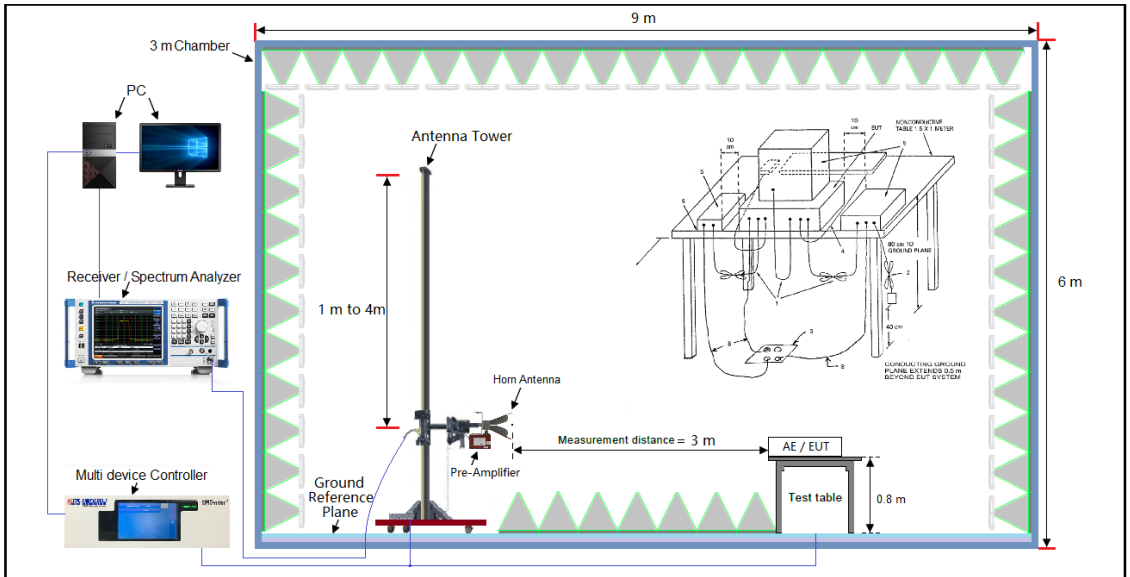
4.3.1 For Radiated Emissions test setup

Figure 1. 30MHz to 1GHz



Test setup for radiated emissions of tabletop equipment (30 MHz to 1 GHz)

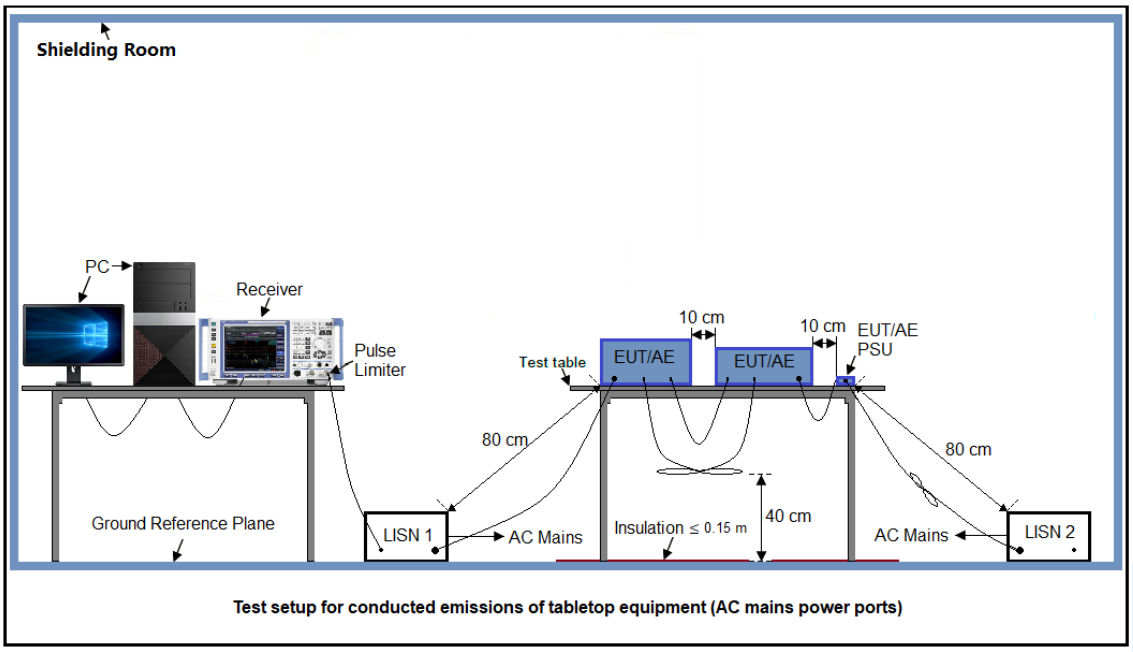
Figure 2. Above 1GHz



Test setup for radiated emissions of tabletop equipment (Above 1 GHz)

4.3.2 For Conducted Emissions test setup

Figure 3. Conducted Emissions setup



4.4 SYSTEM TEST CONFIGURATION

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000MHz. The resolution is 1 MHz or greater for frequencies above 1000MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic (according to KDB 896810 D02 SDoC FAQ v01r01) of the highest fundamental frequency or to 40 GHz, whichever is lower.

5. REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part15 Subpart B	Unintentional Radiators
2	ICES-003 Issue 7	Information Technology Equipment (Including Digital Apparatus)
3	ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
4	KDB 896810 D02 SDoC FAQ v01r02	Supplier's Declaration of Conformity frequency asked questions

6. EMC REQUIREMENTS SPECIFICATION

6.1 RADIATED EMISSION

Test Requirement: FCC 47 CFR Part 15.109
ICES-003 Issue 7 Clause 3.2.2

Test Method: ANSI C63.4-2014

Receiver Setup:

Frequency: (f) (MHz)	Detector type	Measurement receiver bandwidth	
		RBW	VBW
30 ≤ f ≤ 1 000	Quasi Peak	120 kHz	300 kHz
f ≥1000	Peak	1 MHz	3 MHz
	Average	1 MHz	3 MHz

Measured frequency range

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30.
1.705-108	1000.
108-500	2000.
500-1000	5000.
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

Limits:

Limits for Class B devices

FCC 47 CFR Part 15 Subpart B

Frequency (MHz)	limits at 3m (dBμV/m)		
	QP Detector	PK Detector	AV Detector
30 – 88	40.0	--	--
88 – 216	43.5	--	--
216 – 960	46.0		
960 – 1000	54.0	--	--
Above 1000	--	74.0	54.0

ICES-003 Issue 7

Frequency (MHz)	limits at 3m (dBμV/m)		
	QP Detector	PK Detector	AV Detector
30 – 88	40.0	--	--
88 – 216	43.5	--	--
216 – 230	46.0		
230 – 960	47.0	--	--
960 – 1000	54.0	--	--

Above 1000	--	74.0	54.0

Remark:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBμV/m) = 20 log Emission level (μV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

Test Setup: Refer to section 4.3.1 for details.

Test Procedures:

1. From 30 MHz to 1GHz test procedure as below:

1) The Product was placed on the non-conductive turntable 0.8 m above the ground at a chamber.
2) Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 120 kHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied between 1~4 m in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
3) For each frequency whose maximum record was higher or close to limit, measure its QP value: vary the antenna's height and rotate the turntable from 0 to 360 degrees to find the height and degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to QP Detector and specified bandwidth with Maximum Hold Mode, and record the maximum value.

2. Above 1GHz test procedure as below:

1) The Product was placed on the non-conductive turntable 0.8 m above the ground at a chamber.
2) Set the spectrum analyzer/receiver in Peak detector, Max Hold mode, and 1MHz RBW. Record the maximum field strength of all the pre-scan process in the full band when the antenna is varied in both horizontal and vertical, and the turntable is rotated from 0 to 360 degrees.
3) For each frequency whose maximum record was higher or close to limit, measure its AV value: rotate the turntable from 0 to 360 degrees to find the degree where Product radiated the maximum emission, then set the test frequency analyzer/receiver to AV value and specified bandwidth with Maximum Hold Mode, and record the maximum value.

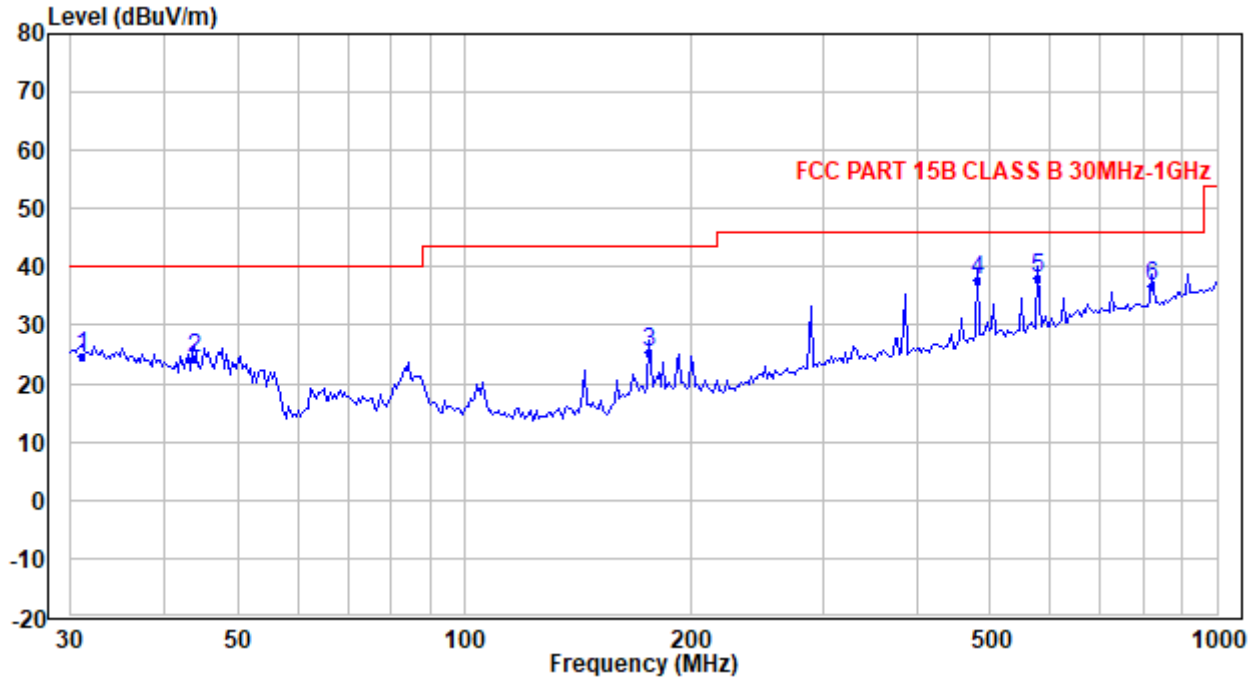
Equipment Used: Refer to section 3 for details.

Test Result: Pass

The measurement data as follows:

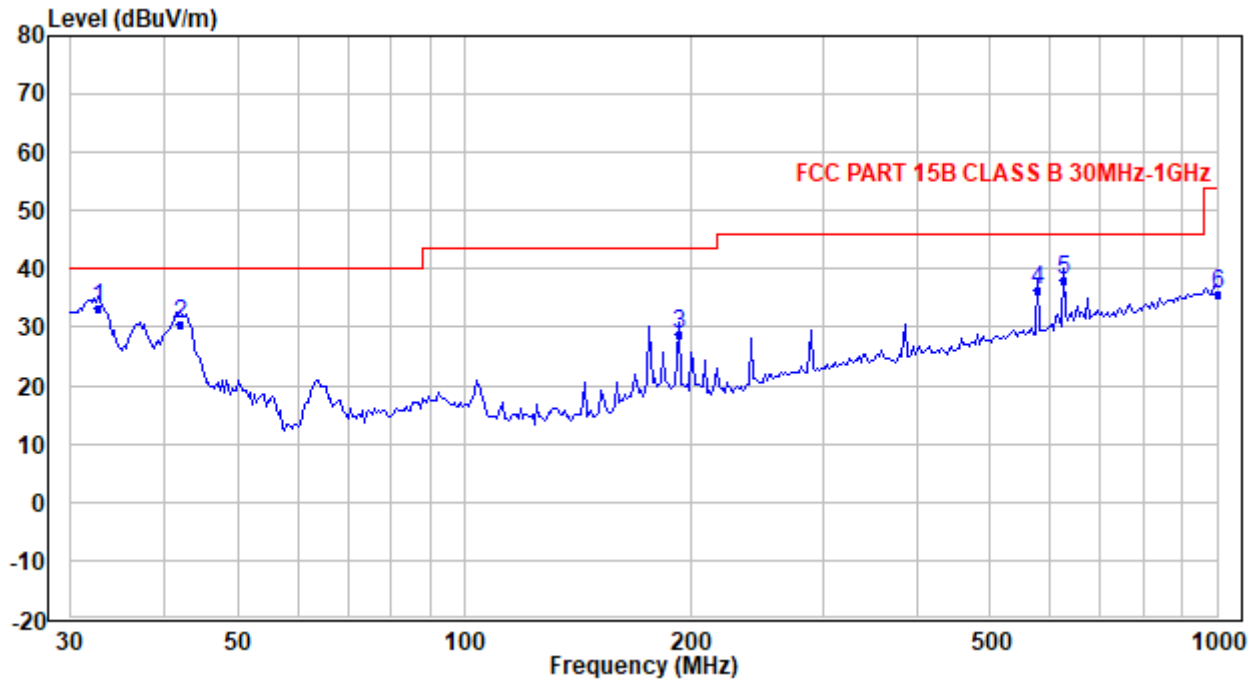
The measurement data for FCC 47 CFR Part 15 Subpart B as follows:

Below 1GHz (Quasi Peak):
Test Mode 4
Horizontal



No.	Frequency (MHz)	Reading (dBµV)	Correction factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	31.073	29.21	-4.51	24.70	40.00	-15.30	QP
2	43.845	34.70	-10.35	24.35	40.00	-15.65	QP
3	176.275	35.62	-10.20	25.42	43.50	-18.08	QP
4	481.511	40.76	-2.91	37.85	46.00	-8.15	QP
5	578.036	39.07	-0.99	38.08	46.00	-7.92	QP
6	821.387	33.75	3.10	36.85	46.00	-9.15	QP

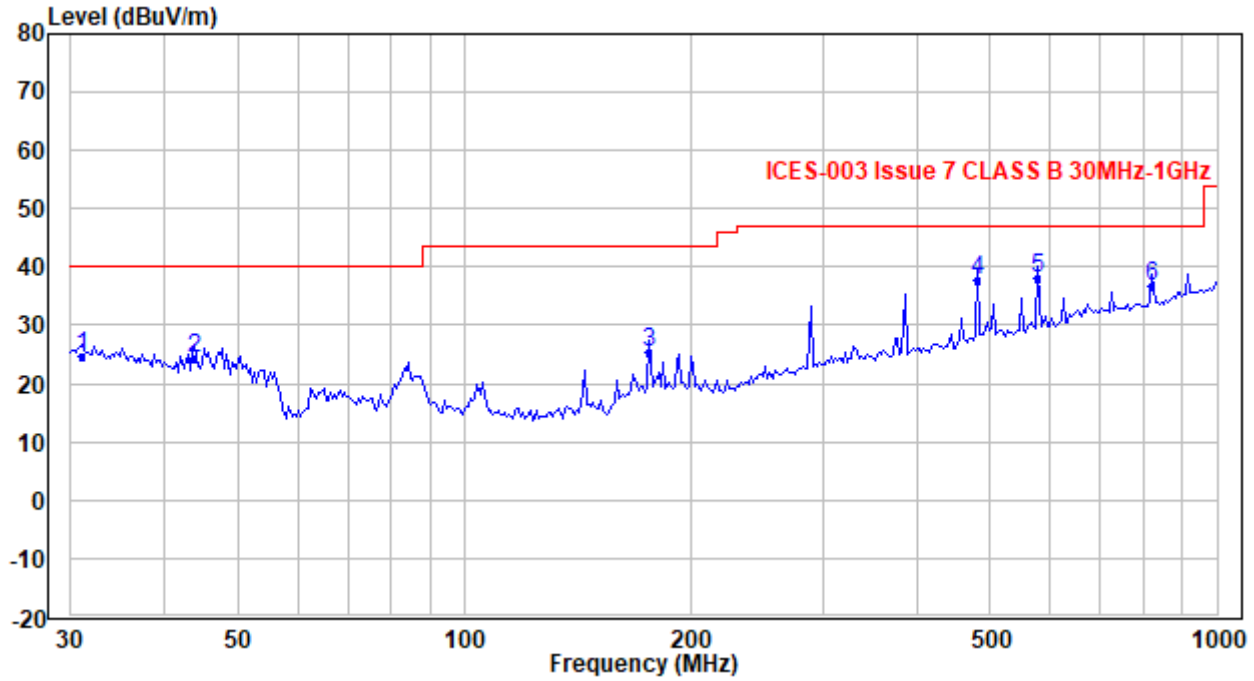
Vertical



No.	Frequency (MHz)	Reading (dBµV)	Correction factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	32.640	38.10	-4.72	33.38	40.00	-6.62	QP
2	42.035	39.63	-9.10	30.53	40.00	-9.47	QP
3	193.137	39.17	-10.24	28.93	43.50	-14.57	QP
4	578.036	37.36	-0.99	36.37	46.00	-9.63	QP
5	624.490	37.71	0.33	38.04	46.00	-7.96	QP
6	1000.000	30.09	5.70	35.79	54.00	-18.21	QP

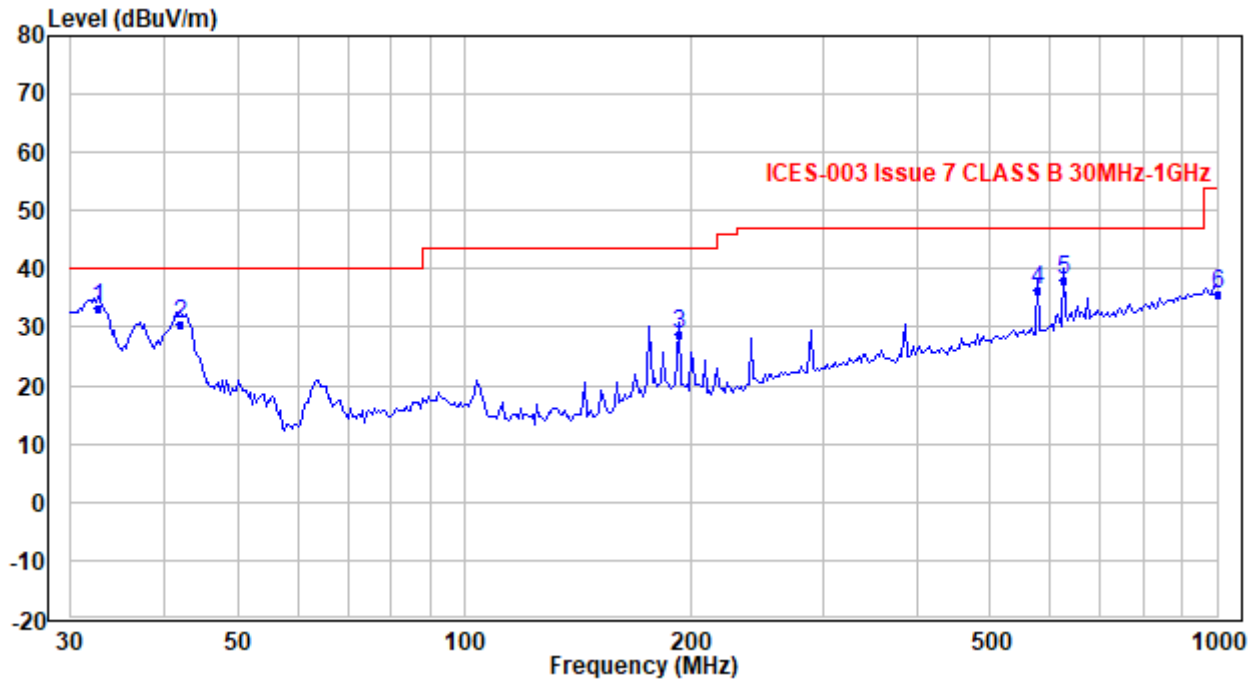
The measurement data for ICES-003 Issue 7 as follows:

Below 1GHz (Quasi Peak):
Test Mode 4
Horizontal



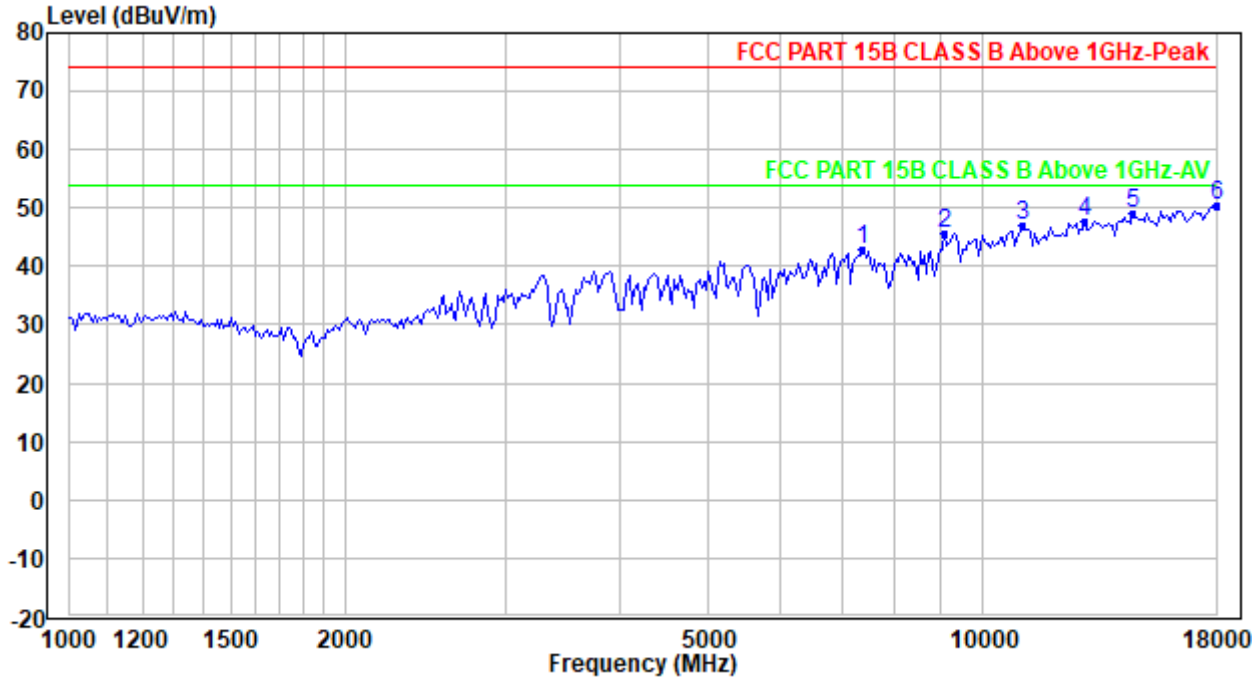
No.	Frequency (MHz)	Reading (dBµV)	Correction factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	31.073	29.21	-4.51	24.70	40.00	-15.30	QP
2	43.845	34.70	-10.35	24.35	40.00	-15.65	QP
3	176.275	35.62	-10.20	25.42	43.50	-18.08	QP
4	481.511	40.76	-2.91	37.85	47.00	-9.15	QP
5	578.036	39.07	-0.99	38.08	47.00	-8.92	QP
6	821.387	33.75	3.10	36.85	47.00	-10.15	QP

Vertical



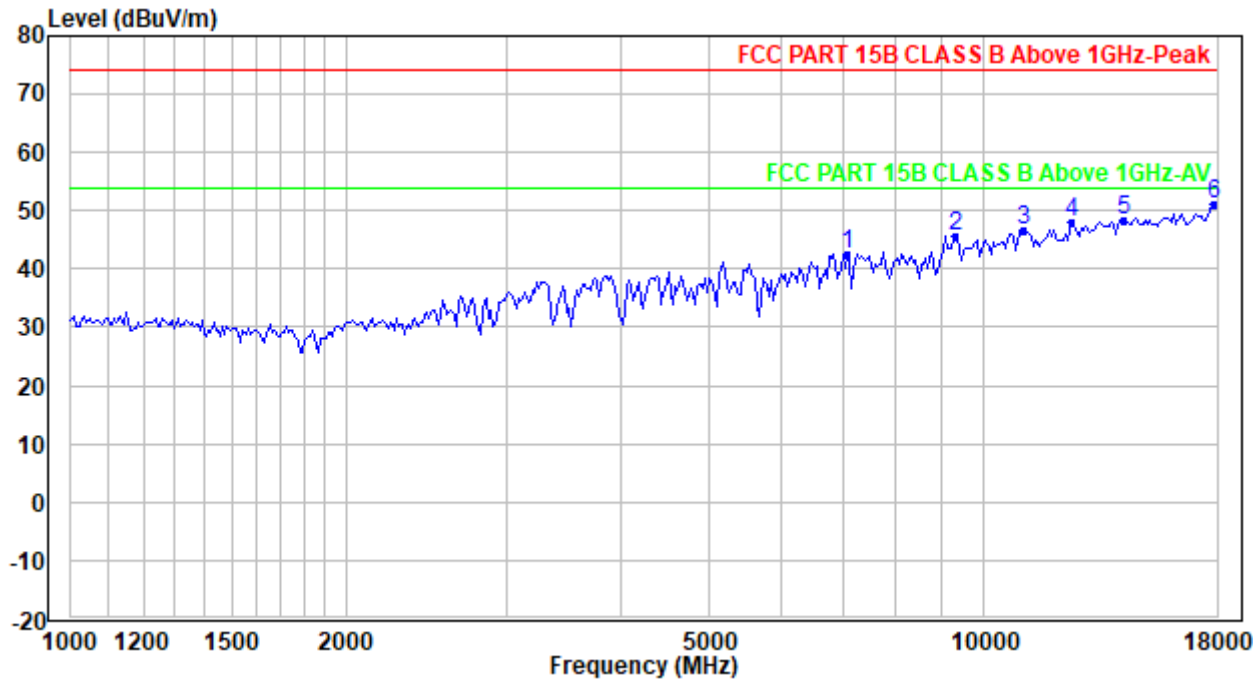
No.	Frequency (MHz)	Reading (dBµV)	Correction factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	32.640	38.10	-4.72	33.38	40.00	-6.62	QP
2	42.035	39.63	-9.10	30.53	40.00	-9.47	QP
3	193.137	39.17	-10.24	28.93	43.50	-14.57	QP
4	578.036	37.36	-0.99	36.37	47.00	-10.63	QP
5	624.490	37.71	0.33	38.04	47.00	-8.96	QP
6	1000.000	30.09	5.70	35.79	54.00	-18.21	QP

Above 1GHz (Peak & Average)
Test Mode 5
Horizontal



No.	Frequency (MHz)	Reading (dBµV)	Correction factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	7376.898	41.25	1.72	42.97	74.00	-31.03	Peak
2	9087.293	40.63	5.11	45.74	74.00	-28.26	Peak
3	11065.320	39.62	7.47	47.09	74.00	-26.91	Peak
4	12938.520	37.38	10.32	47.70	74.00	-26.30	Peak
5	14612.070	36.97	12.11	49.08	74.00	-24.92	Peak
6	18000.000	34.99	15.41	50.40	74.00	-23.60	Peak

Vertical



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	7083.775	41.13	1.54	42.67	74.00	-31.33	Peak
2	9300.297	40.34	5.28	45.62	74.00	-28.38	Peak
3	11065.320	39.30	7.47	46.77	74.00	-27.23	Peak
4	12496.580	39.26	8.74	48.00	74.00	-26.00	Peak
5	14194.950	36.41	12.00	48.41	74.00	-25.59	Peak
6	17896.040	36.03	15.05	51.08	74.00	-22.92	Peak

Remark:

1. Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result – Limit
4. All possible modes of operation were investigated, and testing at two nominal voltages of 12VDC and 24VDC, only the worst case emissions reported.
5. For Radiated Emission above 18GHz, there was not any unwanted emission detected.
6. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

6.2 CONDUCTED EMISSION

Test Requirement: FCC 47 CFR Part 15.107
ICES-003 Issue 7 Section 3.2.1

Test Method: ANSI C63.4-2014

Limits:

Limits for Class B devices

Frequency range (MHz)	Limits (dB(μV)	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50

Remark:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 to 0.50 MHz.

Test Setup: Refer to section 4.3.2 for details.

Test Procedures:

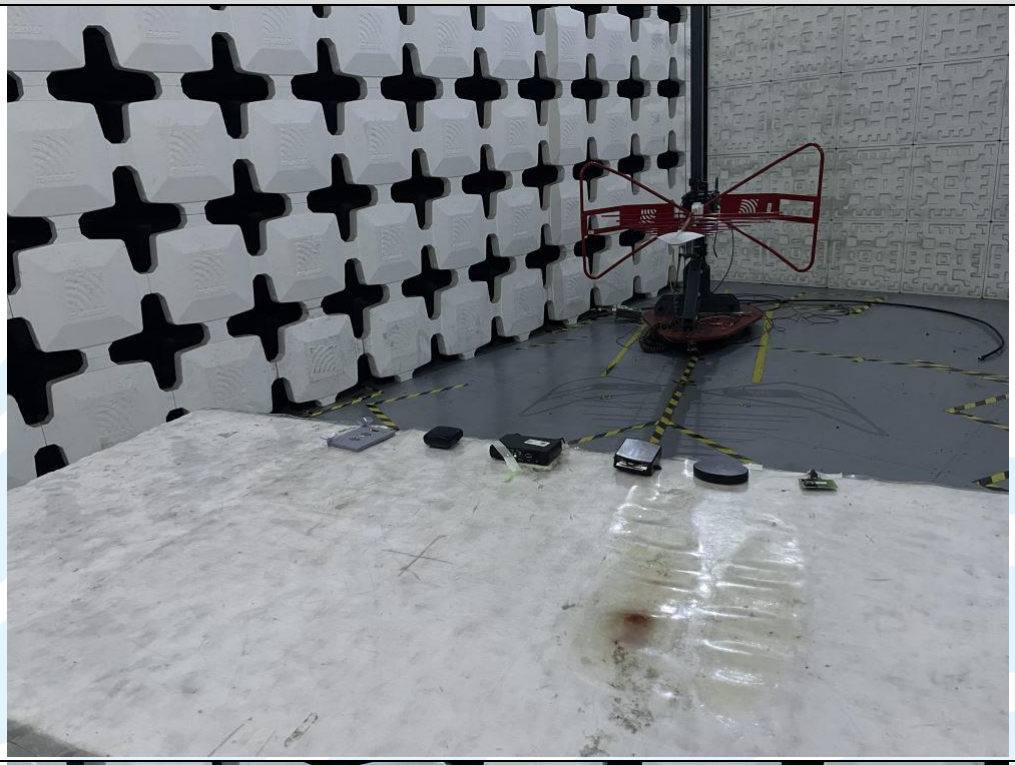
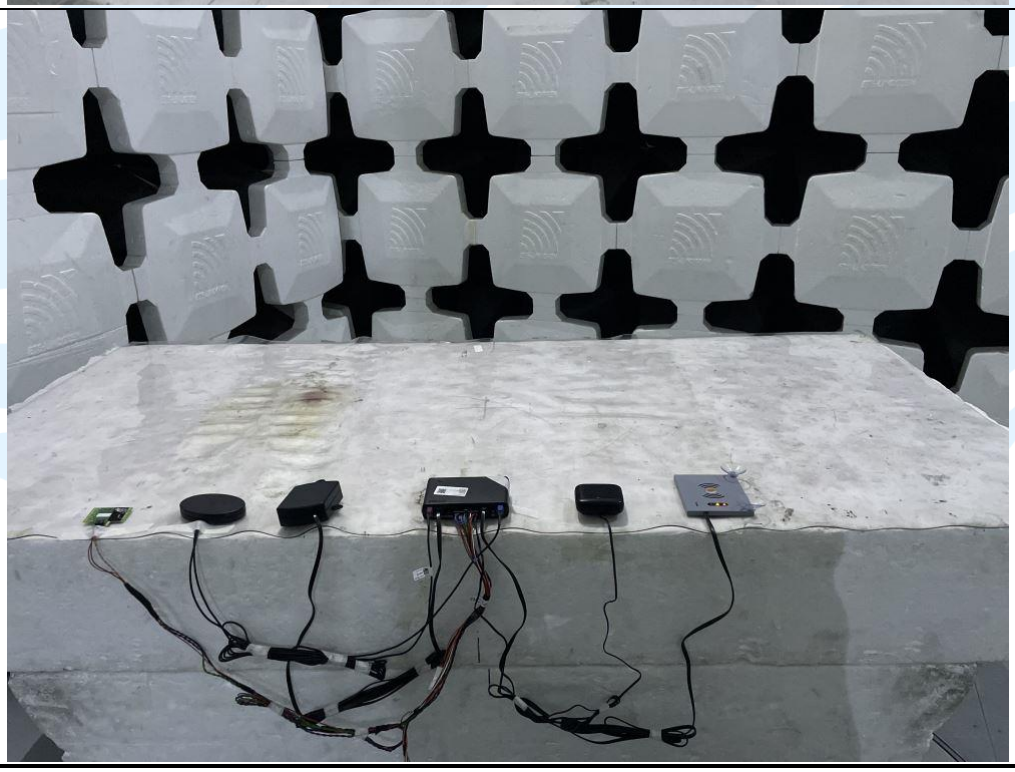
1) The Product was placed on a nonconductive table 0.8 m above the horizontal ground reference plane, and 0.4 m from the vertical ground reference plane, and connected to the main through Line Impedance Stability Network (L.I.S.N).
2) The RBW of the receiver was set at 9 kHz in 150 kHz ~ 30MHz with Peak and AVG detector in Max Hold mode. Run the receiver's pre-scan to record the maximum disturbance generated from Product in all power lines in the full band.
3) For each frequency whose maximum record was higher or close to limit, measure its QP and AVG values and record.

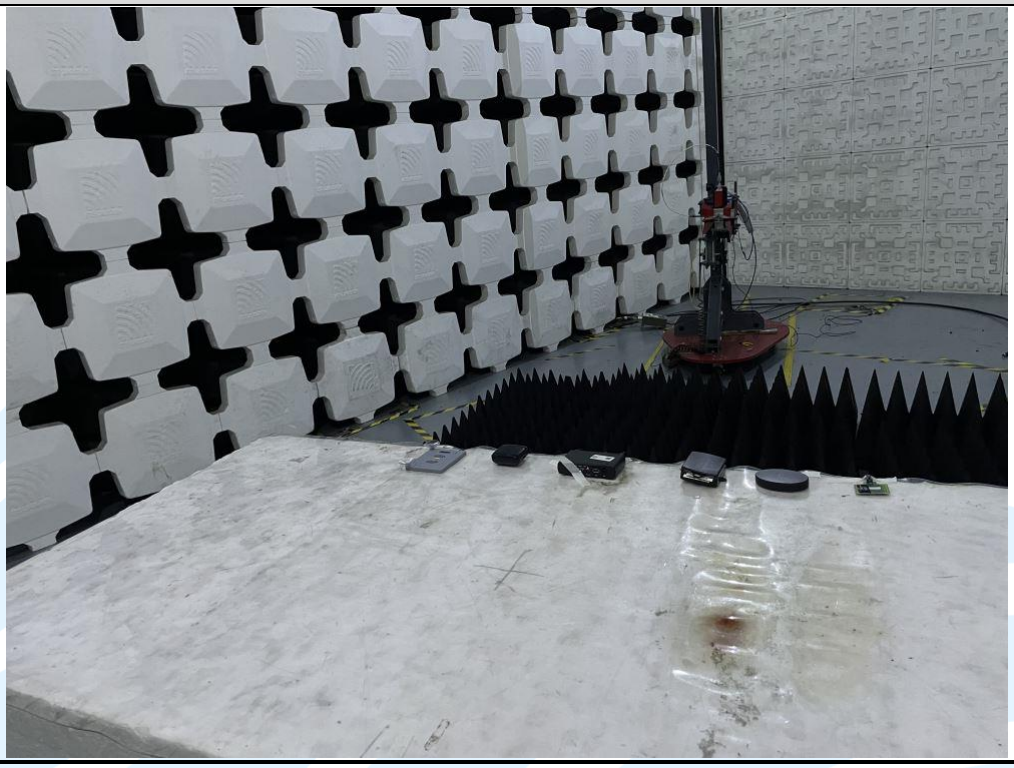
Equipment Used: Refer to section 3 for details.

Test Result: N/A.

Remark: Since the EUT is powered by DC Power Supply, not applicable for this item.

APPENDIX 1 PHOTOS OF TEST SETUP

Radiated emission Test Setup-1 (30 MHz~1 GHz)



Radiated emission Test Setup-2 (Above 1 GHz)


APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photographs.

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

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