TCT 通测检测
TESTING CENTRE TECHNOLOGY

TEST REPORT

FCC ID. ..... :	2BBVL-AION7XX01
Test Report No..... :	TCT240523E013
Date of issue..... :	Jul. 22, 2024
Testing laboratory ..... :	SHENZHEN TONGCE TESTING LAB
Testing location/ address:	2101 & 2201, Zhenchang Factory, Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, 518103, People's Republic of China
Applicant's name..... :	TES Touch Embedded Solutions Inc. Taiwan Branch
Address..... :	7F., No.141, Sec. 3, Ren ai Rd., Da an Dist., Taipei City 106, Taiwan, 222106 China
Manufacturer's name ... :	TES Touch Embedded Solutions Inc. Taiwan Branch
Address..... :	7F., No.141, Sec. 3, Ren ai Rd., Da an Dist., Taipei City 106, Taiwan, 222106 China
Standard(s) ..... :	FCC CFR Title 47 Part 15 Subpart C Section 15.247 FCC KDB 558074 D01 15.247 Meas Guidance v05r02 ANSI C63.10:2013
Product Name..... :	AIO Core Board module
Trade Mark ..... :	TES/MicroTouch
Model/Type reference..... :	AION7XX01
Rating(s)..... :	DC 4.2V
Date of receipt of test item ..... :	May 23, 2024
Date (s) of performance of test..... :	May 23, 2024 ~ Jul. 22, 2024
Tested by (+signature) ... :	Aaron MO
Check by (+signature).... :	Beryl ZHAO
Approved by (+signature):	Tomsin

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1. General Product Information

1.1. EUT description

Product Name.....:	AIO Core Board module
Model/Type reference.....:	AION7XX01
Sample Number.....:	TCT240523E013-0101
Bluetooth Version .....:	V5.2 (This report is for BDR+EDR)
Operation Frequency .....:	2402MHz~2480MHz
Transfer Rate .....:	1/2/3 Mbits/s
Number of Channel .....:	79
Modulation Type.....:	GFSK, π/4-DQPSK, 8DPSK
Modulation Technology .....:	FHSS
Antenna Type.....:	External Antenna
Antenna Gain.....:	Support two antenna: Antenna a: -1.96dBi Antenna b: 1.54dBi
Rating(s).....:	DC 4.2V

Note: The antenna gain listed in this report is provided by applicant, and the test laboratory is not responsible for this parameter.

1.2. Model(s) list

None.

1.3. Operation Frequency

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
…	…	…	…	…	…	…	…
10	2412MHz	30	2432MHz	50	2452MHz	70	2472MHz
11	2413MHz	31	2433MHz	51	2453MHz	71	2473MHz
…	…	…	…	…	…	…	…
18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz
19	2421MHz	39	2441MHz	59	2461MHz	-	

Remark: Channel 0, 39 & 78 have been tested for GFSK, π/4-DQPSK, 8DPSK modulation mode.

2. Test Result Summary

Requirement	CFR 47 Section	Result
Antenna Requirement	§15.203/§15.247 (c)	PASS
AC Power Line Conducted Emission	§15.207	PASS
Conducted Peak Output Power	§15.247 (b)(1)	PASS
20dB Occupied Bandwidth	§15.247 (a)(1)	PASS
Carrier Frequencies Separation	§15.247 (a)(1)	PASS
Hopping Channel Number	§15.247 (a)(1)	PASS
Dwell Time	§15.247 (a)(1)	PASS
Radiated Emission	§15.205/§15.209	PASS
Band Edge	§15.247(d)	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.*
5. *Those test results (Conducted Emission, Conducted Output Power, 20dB Occupied Bandwidth, Carrier Frequencies Separation, Hopping Channel Number, Dwell Time, Band Edge) was based on FCC ID: 2BBVL-AION7XX01; Change antenna.*

3. General Information

3.1. Test environment and mode

Operating Environment:	
Condition	Radiated Emission
Temperature:	25.1 °C
Humidity:	53 % RH
Atmospheric Pressure:	1010 mbar
Voltage:	DC 4.2V by Mainboard (Mainboard power by adapter)
Test Software:	
Software Information:	ADB Tool
Power Level:	Ox05
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel
The sample was placed 0.8m & 1.5m for the measurement below & above 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 (Z axis) are shown in Test Results of the following pages. DH1 DH3 DH5 all have been tested, only worse case DH1 is reported.	

3.2. 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.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
BOX PC	TBX-100N7020011002	/	/	MicroTouch
Media Player	IDX-300	/	/	MicroTouch

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.*
3. *For conducted measurements (Output Power, 20dB Occupied Bandwidth, Carrier Frequencies Separation, Hopping Channel Number, Dwell Time, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.*

4. Facilities and Accreditations

4.1. Facilities

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

- FCC - Registration No.: 645098
  SHENZHEN TONGCE TESTING LAB
  Designation Number: CN1205
  The testing lab has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.
- IC - Registration No.: 10668A-1
  SHENZHEN TONGCE TESTING LAB
  CAB identifier: CN0031
  The testing lab has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing.

4.2. Location

SHENZHEN TONGCE TESTING LAB
Address: 2101 & 2201, Zhenchang Factory, Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, 518103, People's Republic of China
TEL: +86-755-27673339

4.3. Measurement Uncertainty

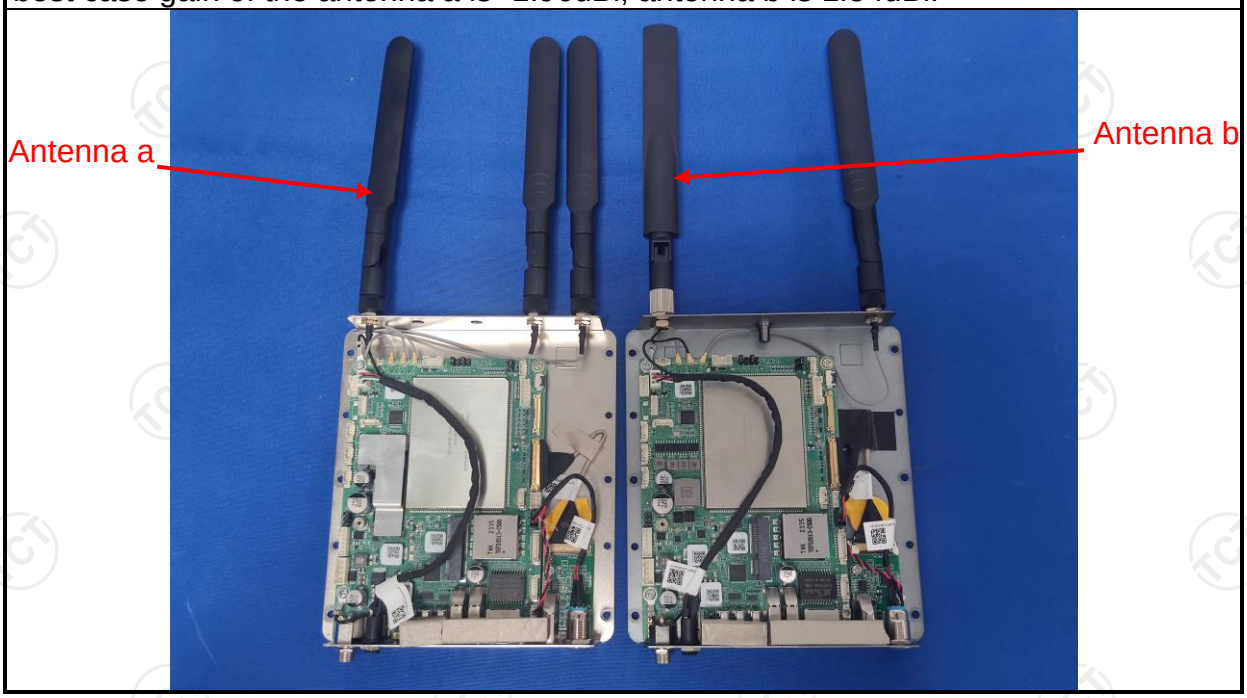
The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	± 3.10 dB
2	RF power, conducted	± 0.12 dB
3	Spurious emissions, conducted	± 0.11 dB
4	All emissions, radiated(<1 GHz)	± 4.56 dB
5	All emissions, radiated(1 GHz - 18 GHz)	± 4.22 dB
6	All emissions, radiated(18 GHz- 40 GHz)	± 4.36 dB

5. Test Results and Measurement Data

5.1. Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
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. 15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.	
E.U.T Antenna:	
The EUT test with a external antenna for maximum gain which are detachable, and the best case gain of the antenna a is -1.96dBi, antenna b is 1.54dBi.	



5.2. Radiated Spurious Emission Measurement

5.2.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.209
Test Method:	ANSI C63.10:2013
Frequency Range:	9 kHz to 25 GHz
Measurement Distance:	3 m
Antenna Polarization:	Horizontal & Vertical

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value
150kHz-30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
Above 1GHz	Peak	1MHz	3MHz	Peak Value
	Peak	1MHz	10Hz	Average Value

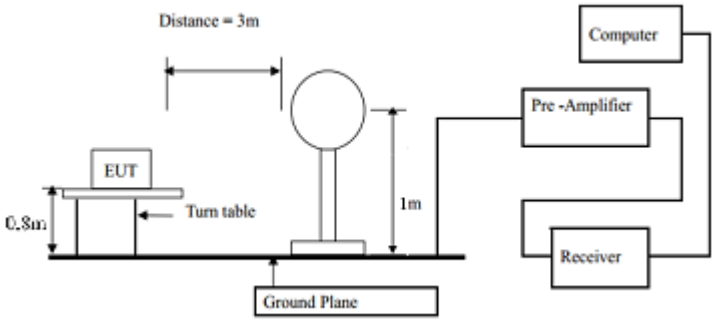
Limit:

Frequency	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	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

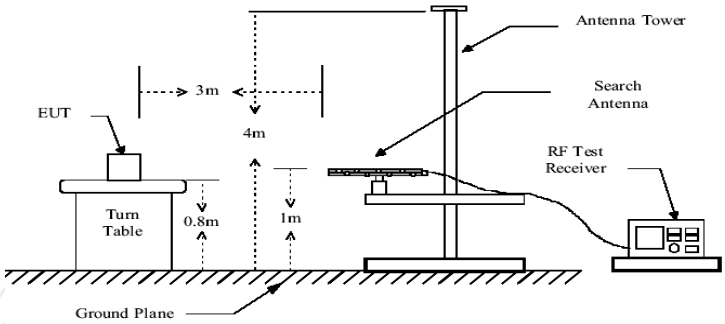
Frequency	Field Strength (microvolts/meter)	Measurement Distance (meters)	Detector
Above 1GHz	500	3	Average
	5000	3	Peak

Test setup:

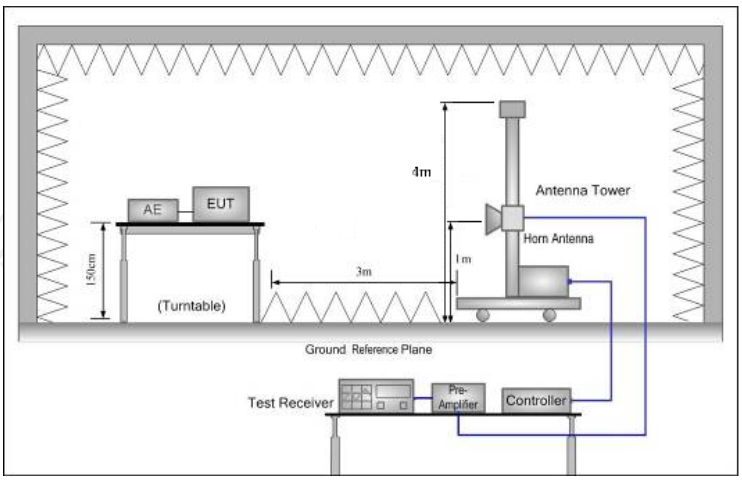
For radiated emissions below 30MHz



30MHz to 1GHz



Above 1GHz



Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10:2013 Measurement Guidelines. 2. For the radiated emission test below 1GHz: The EUT was placed on a turntable with 0.8 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high PASS filter are used for the test in order to get better signal level. For the radiated emission test above 1GHz: Place the measurement antenna on a turntable with 1.5 meter above ground, which is away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission

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	and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Use the following spectrum analyzer settings: (1) Span shall wide enough to fully capture the emission being measured; (2) Set RBW=120 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak (3) For average measurement: use duty cycle correction factor method per 15.35(c). Duty cycle = On time/100 milliseconds On time =N1*L1+N2*L2+...+Nn-1*LNn-1+Nn*Ln Where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc. Average Emission Level = Peak Emission Level + 20*log(Duty cycle) Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
Test results:	PASS

5.2.2. Test Instruments

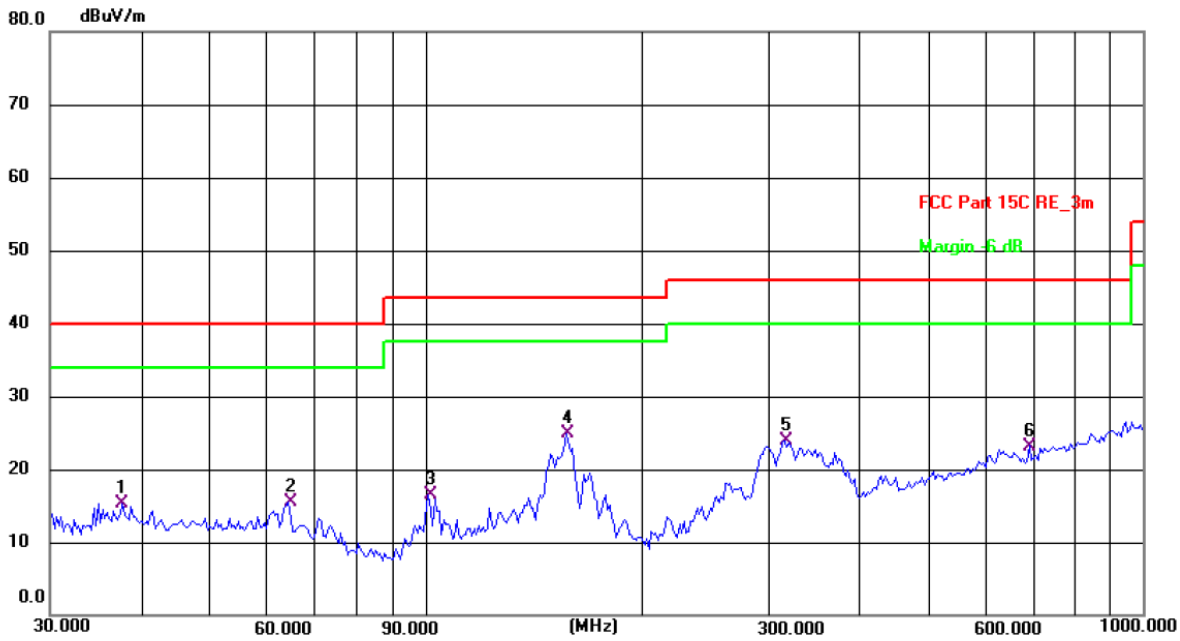
Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESCI7	100529	Jan. 31, 2025
Spectrum Analyzer	R&S	FSQ40	200061	Jun. 26, 2025
Pre-amplifier	HP	8447D	2727A05017	Jun. 26, 2025
Pre-amplifier	SKET	LNPA_0118G-45	SK2021012102	Jan. 31, 2025
Pre-amplifier	SKET	LNPA_1840G-50	SK202109203500	Jan. 31, 2025
Loop antenna	Schwarzbeck	FMZB1519B	00191	Jun. 26, 2025
Broadband Antenna	Schwarzbeck	VULB9163	340	Jun. 28, 2025
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Jun. 28, 2025
Horn Antenna	Schwarzbeck	BBHA 9170	00956	Feb. 02, 2025
Coaxial cable	SKET	RE-03-D	/	Jun. 26, 2025
Coaxial cable	SKET	RE-03-M	/	Jun. 26, 2025
Coaxial cable	SKET	RE-03-L	/	Jun. 26, 2025
Coaxial cable	SKET	RE-04-D	/	Jun. 26, 2025
Coaxial cable	SKET	RE-04-M	/	Jun. 26, 2025
Coaxial cable	SKET	RE-04-L	/	Jun. 26, 2025
Antenna Mast	Keleto	RE-AM	/	/
EMI Test Software	EZ_EMC	FA-03A2 RE+	1.1.4.2	/

5.2.3. Test Data

Please refer to following diagram for individual

Below 1GHz

Horizontal:

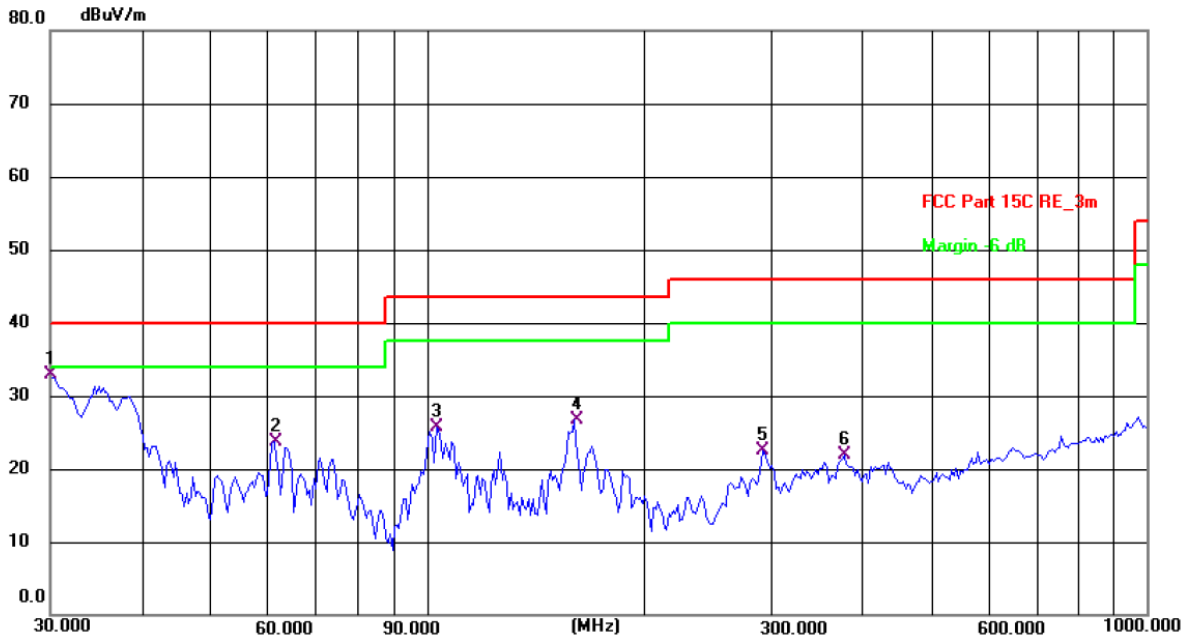


Site: 3m Anechoic Chamber1 Polarization: ***Horizontal*** Temperature: 25.1(C) Humidity: 53 %

Limit: FCC Part 15C RE_3m Power: DC 4.2 V

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	37.8121	27.55	-12.17	15.38	40.00	-24.62	QP	P	
2	64.4331	28.77	-13.36	15.41	40.00	-24.59	QP	P	
3	100.9339	31.87	-15.32	16.55	43.50	-26.95	QP	P	
4 *	157.0074	36.11	-11.28	24.83	43.50	-18.67	QP	P	
5	316.5890	34.23	-10.42	23.81	46.00	-22.19	QP	P	
6	694.4174	27.50	-4.30	23.20	46.00	-22.80	QP	P	

Vertical:



Site: 3m Anechoic Chamber1 Polarization: ***Vertical*** Temperature: 25.1(C) Humidity: 53 %

Limit: FCC Part 15C RE_3m Power: DC 4.2 V

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1 *	30.0000	45.88	-13.00	32.88	40.00	-7.12	QP	P	
2	61.3463	36.47	-12.86	23.61	40.00	-16.39	QP	P	
3	103.0800	40.72	-15.09	25.63	43.50	-17.87	QP	P	
4	160.3456	38.01	-11.37	26.64	43.50	-16.86	QP	P	
5	293.0842	33.51	-11.05	22.46	46.00	-23.54	QP	P	
6	379.9141	31.37	-9.55	21.82	46.00	-24.18	QP	P	

Note: *1. The low frequency, which started from 9KHz~30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.*

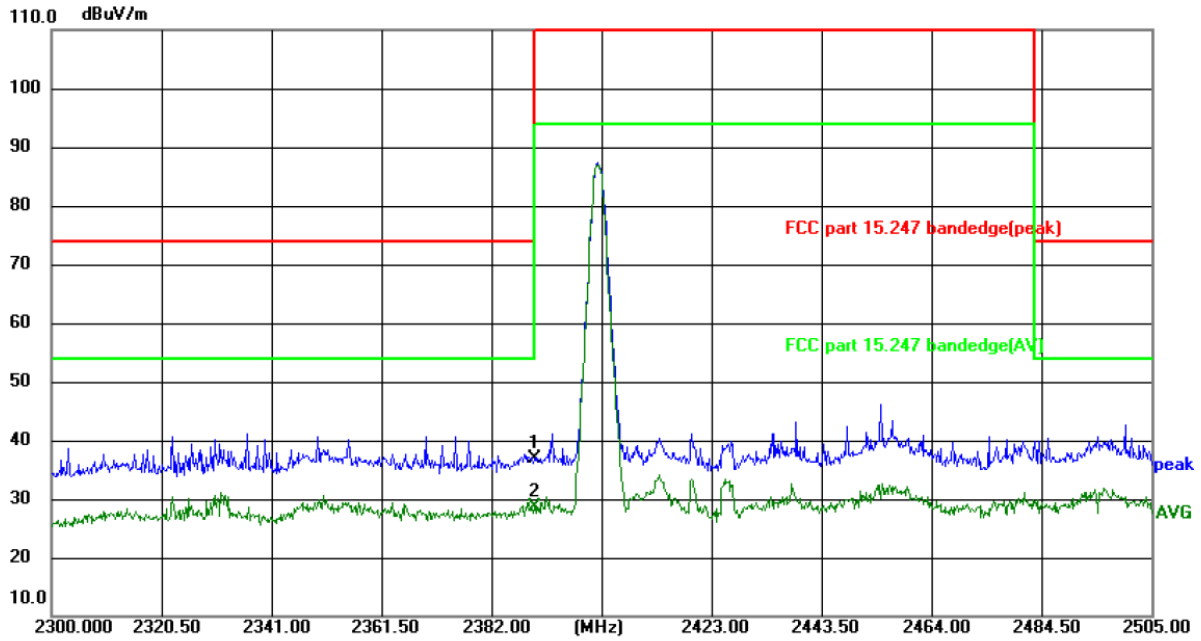
2. Measurements were conducted in all three channels (high, middle, low) and three modulation (GFSK, Pi/4 DQPSK, 8DPSK) and the worst case Mode (Middle channel and 8DPSK) was submitted only. Antenna a and Antenna b have been tested, but the test data only show the worst case model (Antenna b) in this report.

3. Freq. = Emission frequency in MHz
Measurement (dBμV/m) = Reading level (dBμV) + Corr. Factor (dB)
Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
Limit (dBμV/m) = Limit stated in standard
Over (dB) = Measurement (dBμV/m) – Limits (dBμV/m)
** is meaning the worst frequency has been tested in the test frequency range.*

Test Result of Radiated Spurious at Band edges

Lowest channel 2402:

Horizontal:

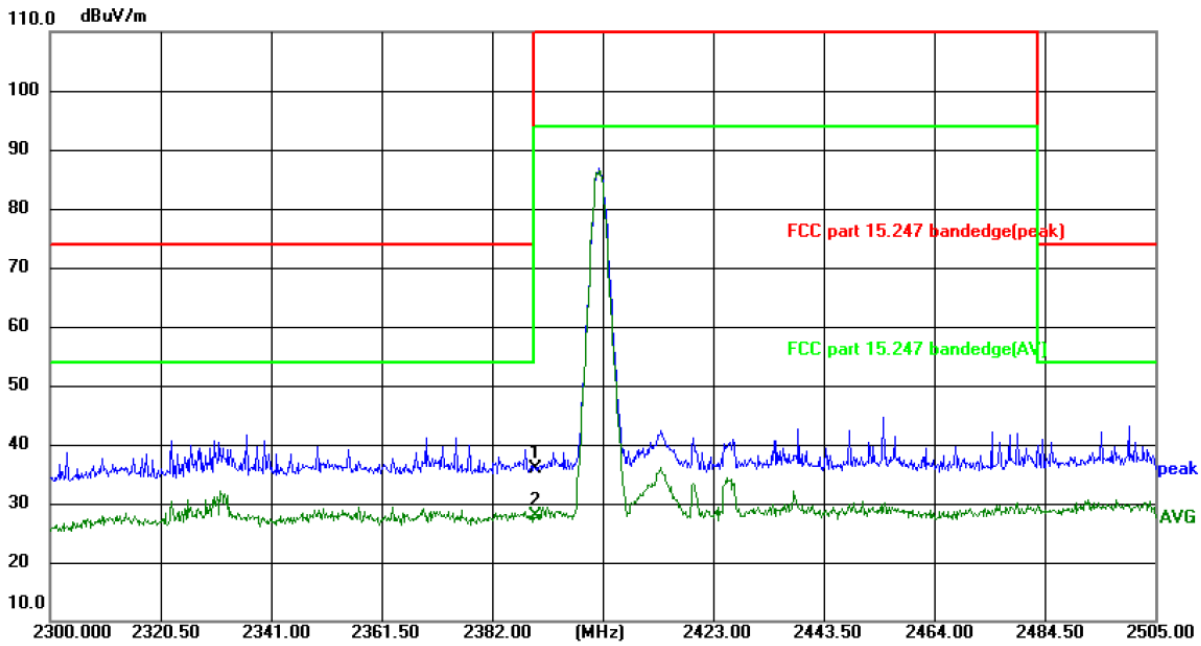


Site: 3m Anechoic Chamber Polarization: ***Horizontal*** Temperature: 23.1(℃) Humidity: 60 %

Limit: FCC part 15.247 bandedge(peak) Power: DC 4.2 V

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	2390.000	52.78	-15.86	36.92	74.00	-37.08	peak	P	
2 *	2390.000	44.58	-15.86	28.72	54.00	-25.28	AVG	P	

Vertical:



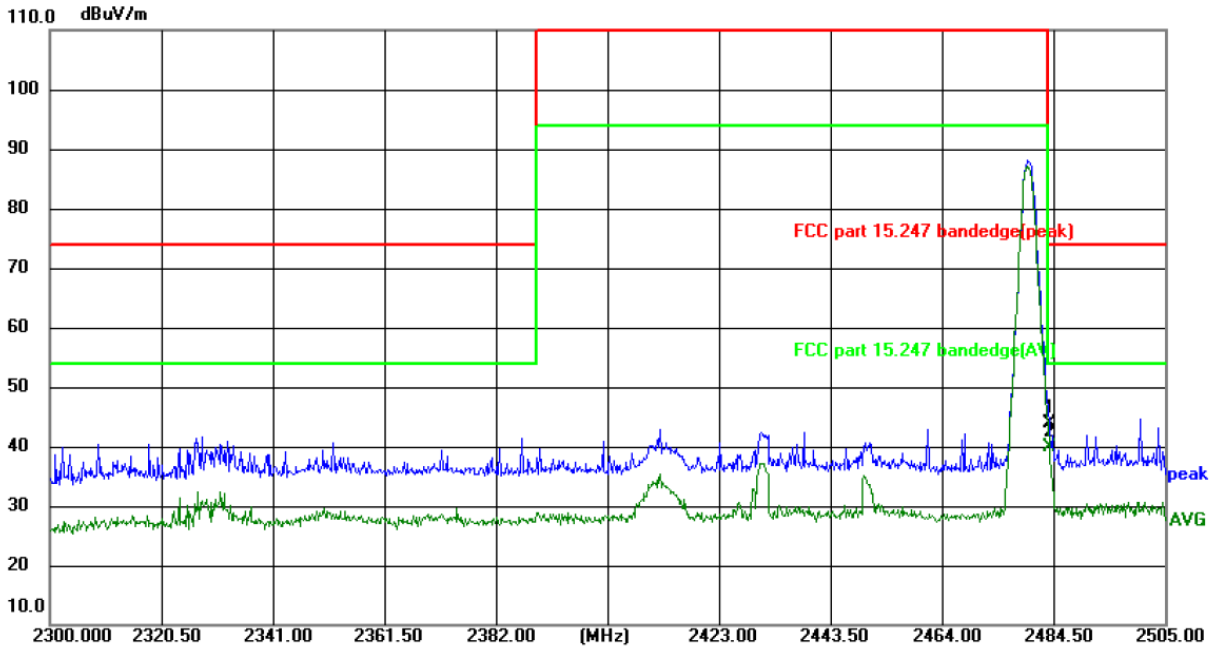
Site: 3m Anechoic Chamber Polarization: ***Vertical*** Temperature: 23.1(℃) Humidity: 60 %

Limit: FCC part 15.247 bandedge(peak) Power: DC 4.2 V

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	2390.000	51.78	-15.86	35.92	74.00	-38.08	peak	P	
2 *	2390.000	43.66	-15.86	27.80	54.00	-26.20	AVG	P	

Highest channel 2480:

Horizontal:

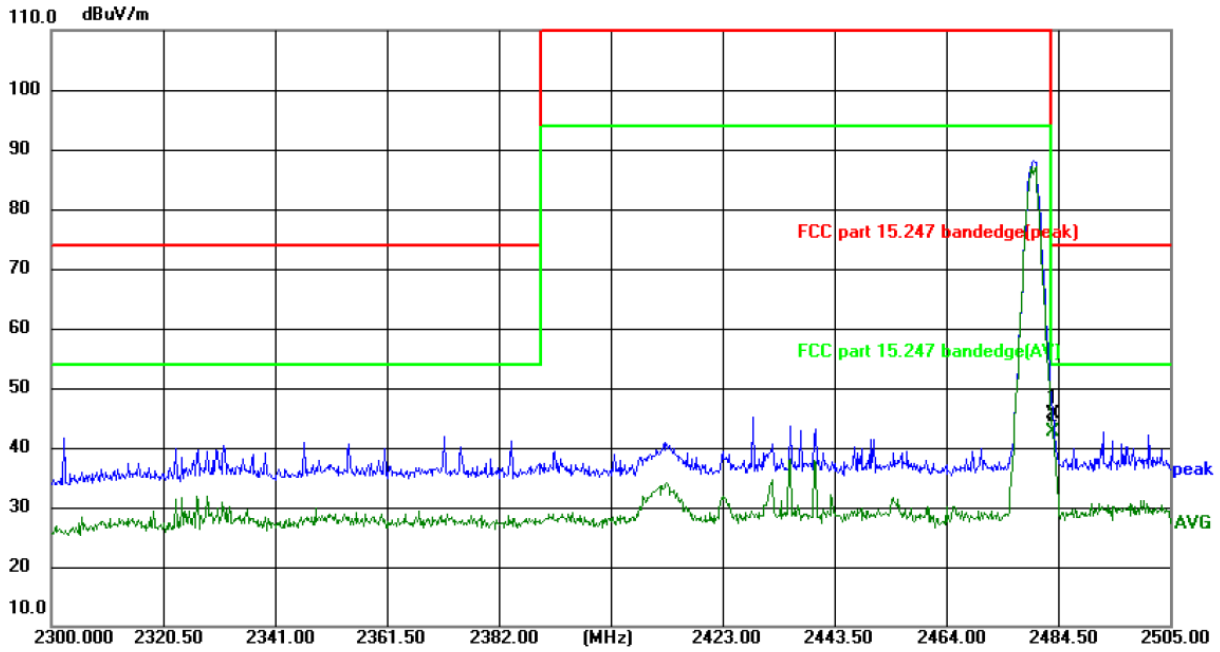


Site: 3m Anechoic Chamber Polarization: ***Horizontal*** Temperature: 23.1(℃) Humidity: 60 %

Limit: FCC part 15.247 bandedge(peak) Power: DC 4.2 V

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	2483.500	59.81	-15.87	43.94	74.00	-30.06	peak	P	
2 *	2483.500	55.78	-15.87	39.91	54.00	-14.09	AVG	P	

Vertical:



Site: 3m Anechoic Chamber Polarization: ***Vertical*** Temperature: 23.1(℃) Humidity: 60 %

Limit: FCC part 15.247 bandedge(peak) Power: DC 4.2 V

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	2483.500	61.44	-15.87	45.57	74.00	-28.43	peak	P	
2 *	2483.500	58.46	-15.87	42.59	54.00	-11.41	AVG	P	

Note: *1. Measurements were conducted in all three modulation (GFSK, Pi/4 DQPSK, 8DPSK), and the worst case Mode (8DPSK) was submitted only.*

2. Antenna a and Antenna b have been tested, but the test data only show the worst case model (Antenna b) in this report.

Above 1GHz

Modulation Type: 8DPSK									
Low channel: 2402 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBuV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4804	H	44.62	---	0.66	45.28	---	74	54	-8.72
7206	H	34.99	---	9.50	44.49	---	74	54	-9.51
---	H	---	---	---	---	---	---	---	---
4804	V	45.25	---	0.66	45.91	---	74	54	-8.09
7206	V	34.87	---	9.50	44.37	---	74	54	-9.63
---	V	---	---	---	---	---	---	---	---

Middle channel: 2441 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4882	H	44.94	---	0.99	45.93	---	74	54	-8.07
7323	H	35.21	---	9.87	45.08	---	74	54	-8.92
---	H	---	---	---	---	---	---	---	---
4882	V	44.57	---	0.99	45.56	---	74	54	-8.44
7323	V	34.39	---	9.87	44.26	---	74	54	-9.74
---	V	---	---	---	---	----	---	---	---

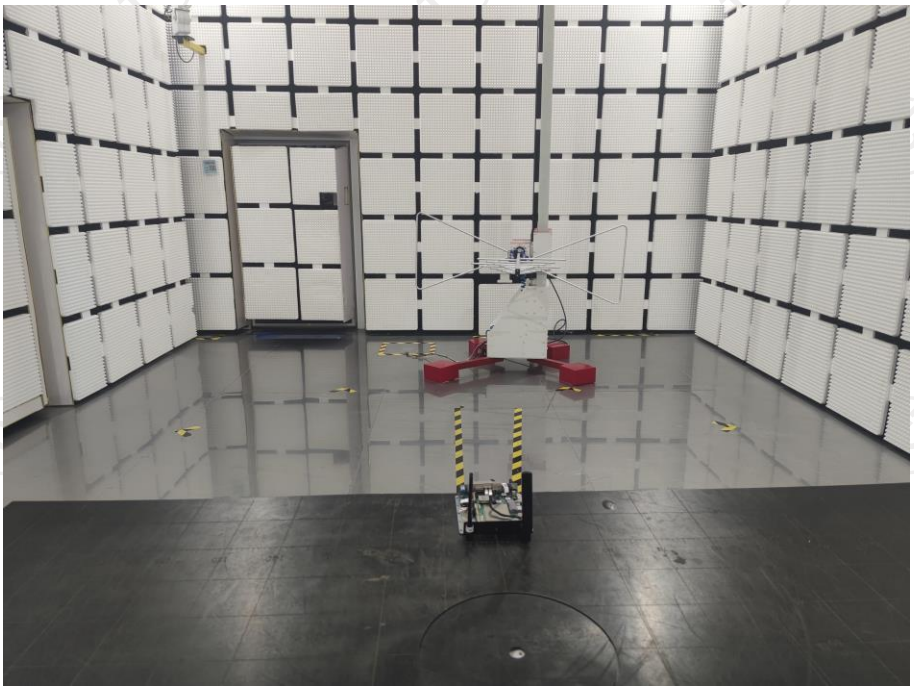
High channel: 2480 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4960	H	45.99	---	1.33	47.32	---	74	54	-6.68
7440	H	35.27	---	10.22	45.49	---	74	54	-8.51
---	H	---	---	---	---	---	---	---	---
4960	V	44.43	---	1.33	45.76	---	74	54	-8.24
7440	V	34.51	---	10.22	44.73	---	74	54	-9.27
---	V	---	---	---	---	---	---	---	---

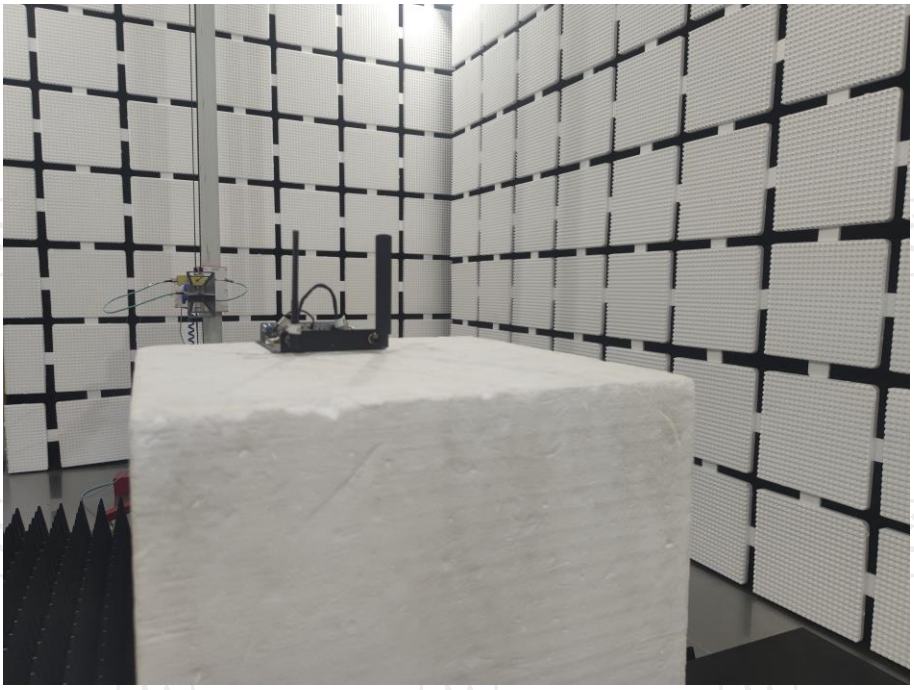
Note:

1. *Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier*
2. *Margin (dB) = Emission Level (Peak) (dBμV/m)-Average limit (dBμV/m)*
3. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
4. *Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.*
5. *Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.*
6. *Measurements were conducted in all three modulation (GFSK, Pi/4 DQPSK, 8DPSK), and the worst case Mode (8DPSK) was submitted only.*
7. *Antenna a and Antenna b have been tested, but the test data only show the worst case model (Antenna b) in this report.*
8. *All the restriction bands are compliance with the limit of 15.209.*

Appendix B: Photographs of Test Setup

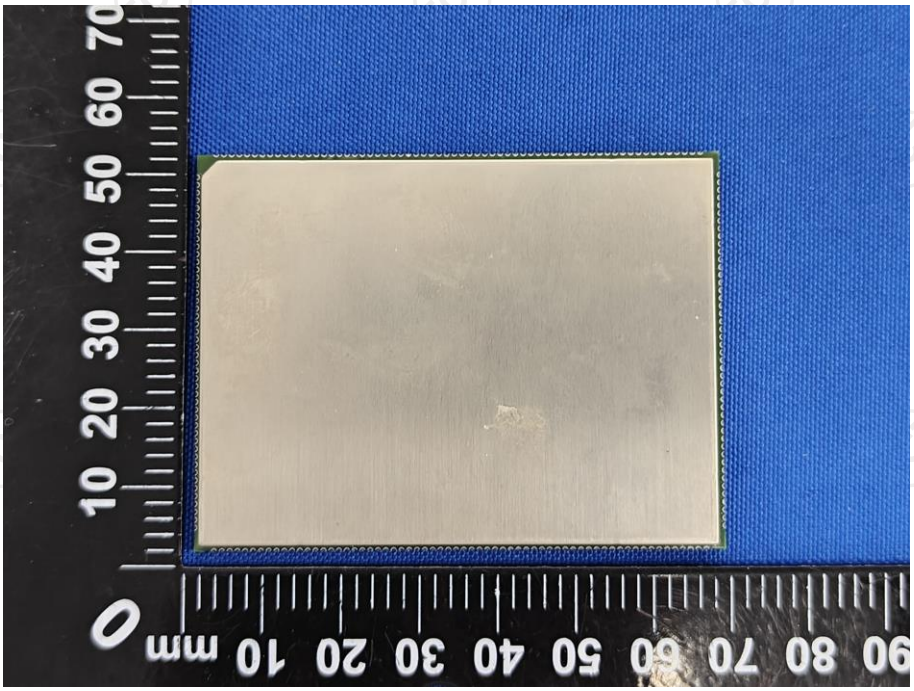
Product: AIO Core Board module
Model: AION7XX01
Radiated Emission

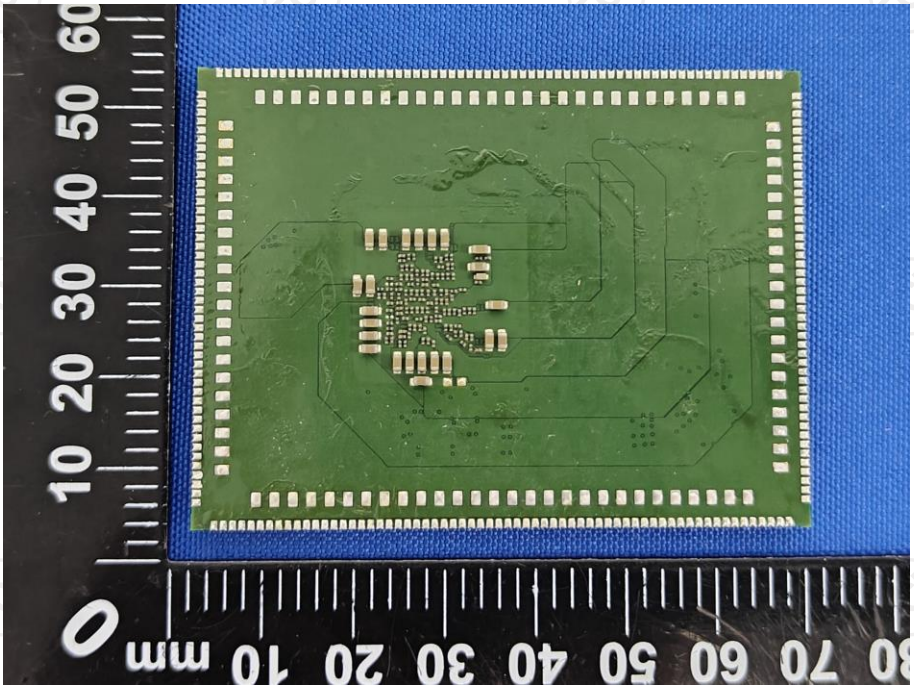




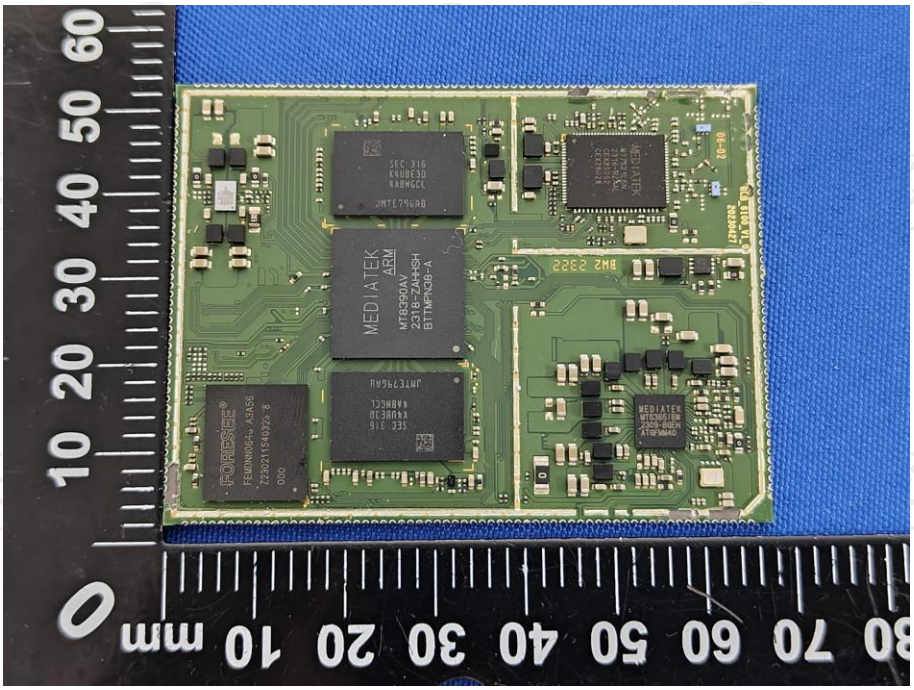
Appendix C: Photographs of EUT

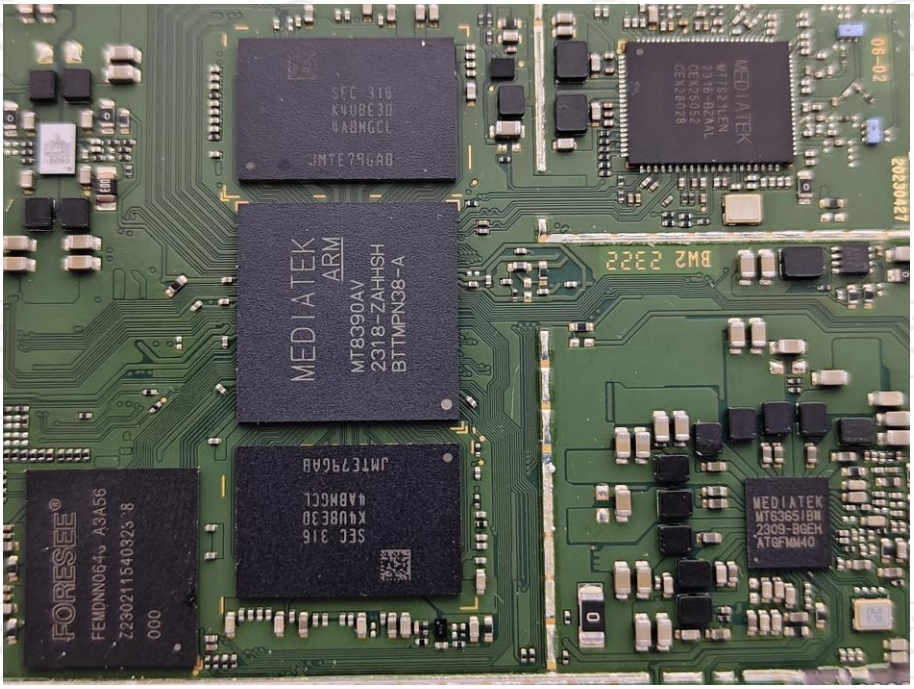
Product: AIO Core Board module
Model: AION7XX01
External Photos





Product: AIO Core Board module
Model: AION7XX01
Internal Photos





********END OF REPORT********