

TEST REPORT

Report No. : SHATBL2310017W02
FCC ID : 2AH3O-TL8822CSL
Product Name : Rapsodo Mini
Brand Name : Rapsodo
Test Model : RB23
Series Model : N/A
Date of Sample Arrival : N/A
Date of Test : 2023.12.06-2023.12.07
Issue Date : 2023.12.07
Test Standards : 47 CFR 15.209

Report Prepared by :

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(Chris Xu)

Report Approved by :

Ghost Li.

(Ghost Li)

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Terry Yang

(Terry Yang)

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Revision History

Rev.	Issue Date	Revisions	Revised by
A0	2023.12.07	Initial Release	Ghost Li

DECLARATION OF REPORT

The device has been tested by ATBL, and the test results show that the equipment under test (EUT) is in compliance with the requirements of 47 CFR 15.209. And it is applicable only to the tested sample identified in the report.

1. This report shall not be reproduced except in full, without the written approval of ATBL, this document only be altered or revised by ATBL, personal only, and shall be noted in the revision of the document.

2. The general information of EUT in this report is provided by the customer or manufacture, ATBL is only responsible for the test data but not for the information provided by the customer or manufacture.

3. The results in this report is only apply to the sample as tested under conditions. The customer or manufacturer is responsible for ensuring that the additional production units of this model have the same electrical and mechanical components.

SUMMARY OF TEST RESULT

Standard Section	Test Item	Judgment	Remark
47 CFR 15.209	Radiated Spurious Emission	PASS	—

1. General Information

1.1. Applicant

Name	:	Rapsodo Pte Ltd
Address	:	Blk 20 Ayer Rajah Crescent, #08-05 singapore,139964 Singapore

1.2. Manufacturer

Name	:	Rapsodo Pte Ltd
Address	:	Blk 20 Ayer Rajah Crescent, #08-05 singapore,139964 Singapore

1.3. Factory

Name	:	PCA Technology
Address	:	12, Jalan Bayu, Kawasan Perindustrian Tampoi Jaya, 81200 Johor Bahru, Johor, Malaysia

1.4. General Description OF The EUT

General Information	
Equipment Name	Rapsodo Mini
Brand Name	Rapsodo
Model Name	RB23
Series Model	N/A
Model Difference	N/A
Operation Frequency	2.4G WLAN: 802.11b/g/n 20: 2412~2462 MHz 802.11n(40MHz):2422~2452MHz
	5G WLAN: 802.11a/ n(HT20)/ac(VHT20):5.180GHz-5.240GHz 802.11n(HT40)/ac(VHT40):5.190GHz-5.230GHz 802.11ac(VHT80): 5.210GHz 802.11a/ n(HT20)/ac(VHT20):5.260GHz-5.320GHz 802.11 n(HT40)/ac(VHT40):5.270GHz-5.310GHz 802.11ac(VHT80): 5.290GHz 802.11a/ n(HT20)/ac(VHT20):5.500GHz-5.700GHz 802.11 n(HT40)/ac(VHT40):5.510GHz-5.670GHz 802.11ac(VHT80): 5.530GHz-5.610GHz
	Radar module:24.075-24.175 GHz
Modulation Type	2.4G WLAN: 802.11b(DSSS):CCK,DQPSK,DBPSK 802.11g(OFDM):BPSK,QPSK,16-QAM,64-QAM 802.11n(OFDM):BPSK,QPSK,16-QAM,64-QAM
	5G WLAN: 802.11a(OFDM):BPSK,QPSK,16-QAM,64-QAM 802.11n(OFDM):BPSK,QPSK,16-QAM,64-QAM 802.11ac(OFDM):BPSK,QPSK,16-QAM,64-QAM,256-QAM
	2.4G/5G WLAN: ANT A: 4.3dBi, ANT B: 4.3 dBi, MIMO A+B:7.31 dBi Radar module:15dBi
Antenna gain	
Antenna Designation	Dipole Antenna, Patch Antenna
Power supply	DC 7.4V by Battery
Hardware version	Rev D
Software version	1.4.2

1.5. Test Factory

Name : Shanghai ATBL Technology Co., Ltd

Address : 5-6/F., Unit 1, No 8, Free Trade One Life Science and Sci-Tech Industrial Park, No. 160
Basheng Road, Pudong, Shanghai, China

1.6. Test Mode

Summary Table of Test Modes	
Radiated Test	BLE+WIFI+Radar Simultaneous launch status

1.7. Radiated Spurious Equipment List

Equipment Name	Manufacturer	Model	Serial No.	Equipment No.	Calibration Until
Signal analyzer	Agilent	N9020A	MY50200811	SHATBL-E017	2024.05.09
Amplifier	JPT	JPA0118-55-303A	1910001800055000	SHATBL-E006	2024.05.09
Amplifier	JPT	JPA-10M1G32	21010100035001	SHATBL-E005	2024.05.09
Antenna/Turn table Controller	Brilliant	N/A	N/A	SHATBL-E007	N/A
Loop Antenna	Daze	ZN30900C	20077	SHATBL-E042	2024.05.12
Bilog Antenna	SCHWARZBECK	VULB 9168	01174	SHATBL-E008	2024.05.12
Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120D	02334	SHATBL-E009	2024.05.12
Horn Antenna	COM-POWER	AH-1840	10100008	SHATBL-E043	2024.09.23
Thermometer	DeLi	N/A	N/A	SHATBL-E015	2024.09.25
Test Software	FALA	EMC-RI	N/A	SHATBL-E046	N/A

1.8. Measurement Uncertainty

The reported uncertainty of measurement $y \pm U$, where expanded 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	Uncertainty
1	All emissions, radiated 30MHz-1GHz	$\pm 2.50\text{dB}$
2	All emissions, radiated 1GHz-18GHz	$\pm 3.51\text{dB}$

2. Radiated Spurious Emission

2.1. Limit

47 CFR 15.205(a): Only spurious emissions are permitted in any of the frequency bands listed below:

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)
0.090-0.110	12.29-12.293	149.9-150.05	1660-1710	8.025-8.5
0.495-0.505	12.51975-12.52025	156.52475-156.52525	1718.8-1722.2	9.0-9.2
2.1735-2.1905	12.57675-12.57725	156.7-156.9	2200-2300	9.3-9.5
4.125-4.128	13.36-13.41	162.0125-167.17	2310-2390	10.6-12.7
4.17725-4.17775	16.42-16.423	167.72-173.2	2483.5-2500	13.25-13.4
4.20725-4.20775	16.69475-16.69525	240-285	2690-2900	14.47-14.5
6.215-6.218	16.80425-16.80475	322-335.4	3260-3267	15.35-16.2
6.26775-6.26825	25.5-25.67	399.9-410	3332-3339	17.7-21.4
6.31175-6.31225	37.5-38.25	608-614	3345.8-3358	22.01-23.12
8.291-8.294	73-74.6	960-1240	3600-4400	23.6-24.0
8.362-8.366	74.8-75.2	1300-1427	4500-5150	31.2-31.8
8.37625-8.38675	108-121.94	1435-1626.5	5350-5460	36.43-36.5
8.41425-8.41475	123-138	1645.5-1646.5	7250-7750	Above 38.6

47 CFR 15.209(a): The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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

2.2. Test Procedure

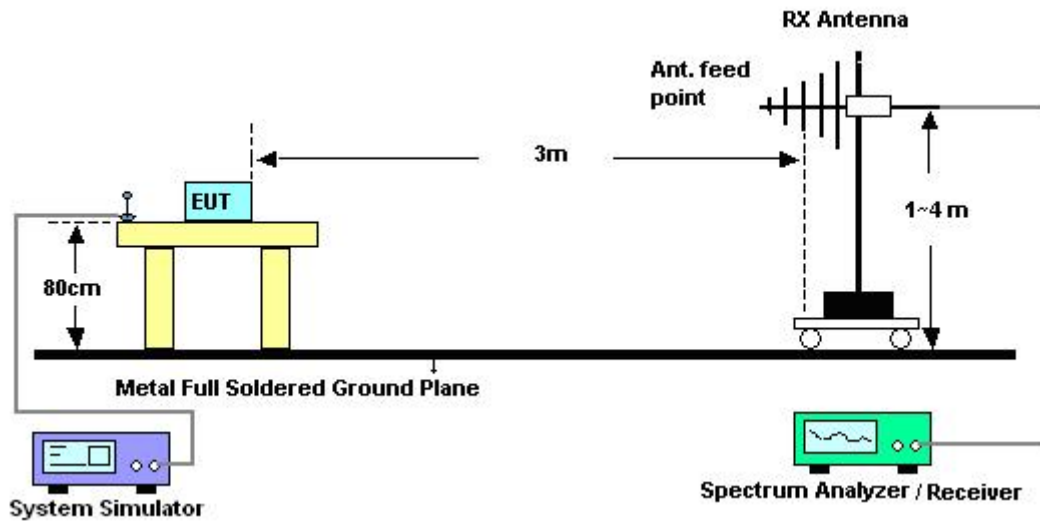
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, 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 to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:
 - ① Span shall wide enough to fully capture the emission being measured;
 - ② Set RBW=100 kHz for $f < 1$ GHz, RBW=1MHz for $f > 1$ GHz ; VBW $\geq$ 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 + $20*\log(\text{Duty cycle})$
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Pre-amp Factor = Level
7. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

Remark:

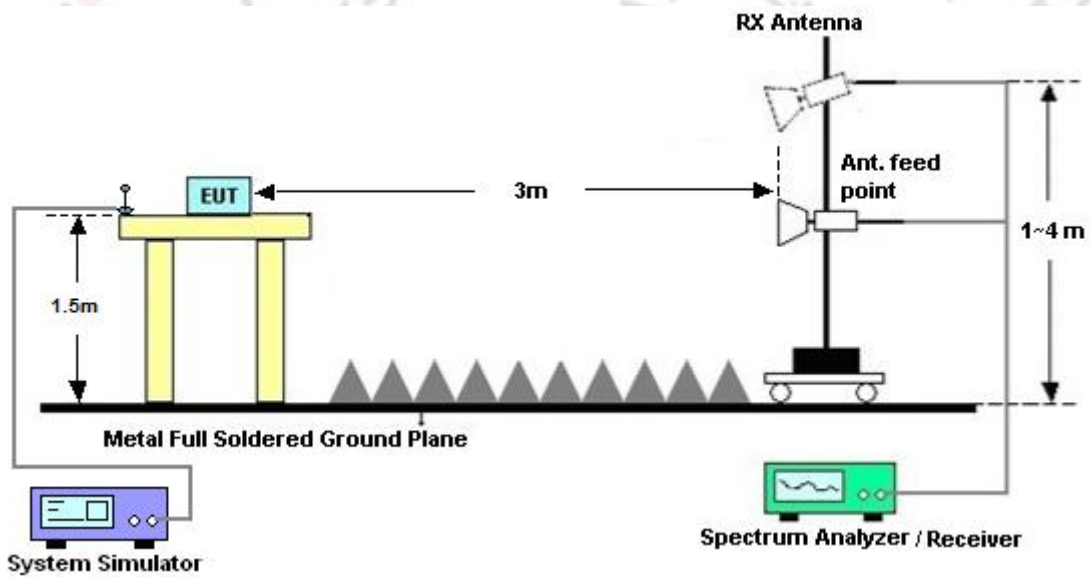
The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.70dB) derived from $20\log(\text{dwell time}/100\text{ms})$. This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

2.3. Test Setup

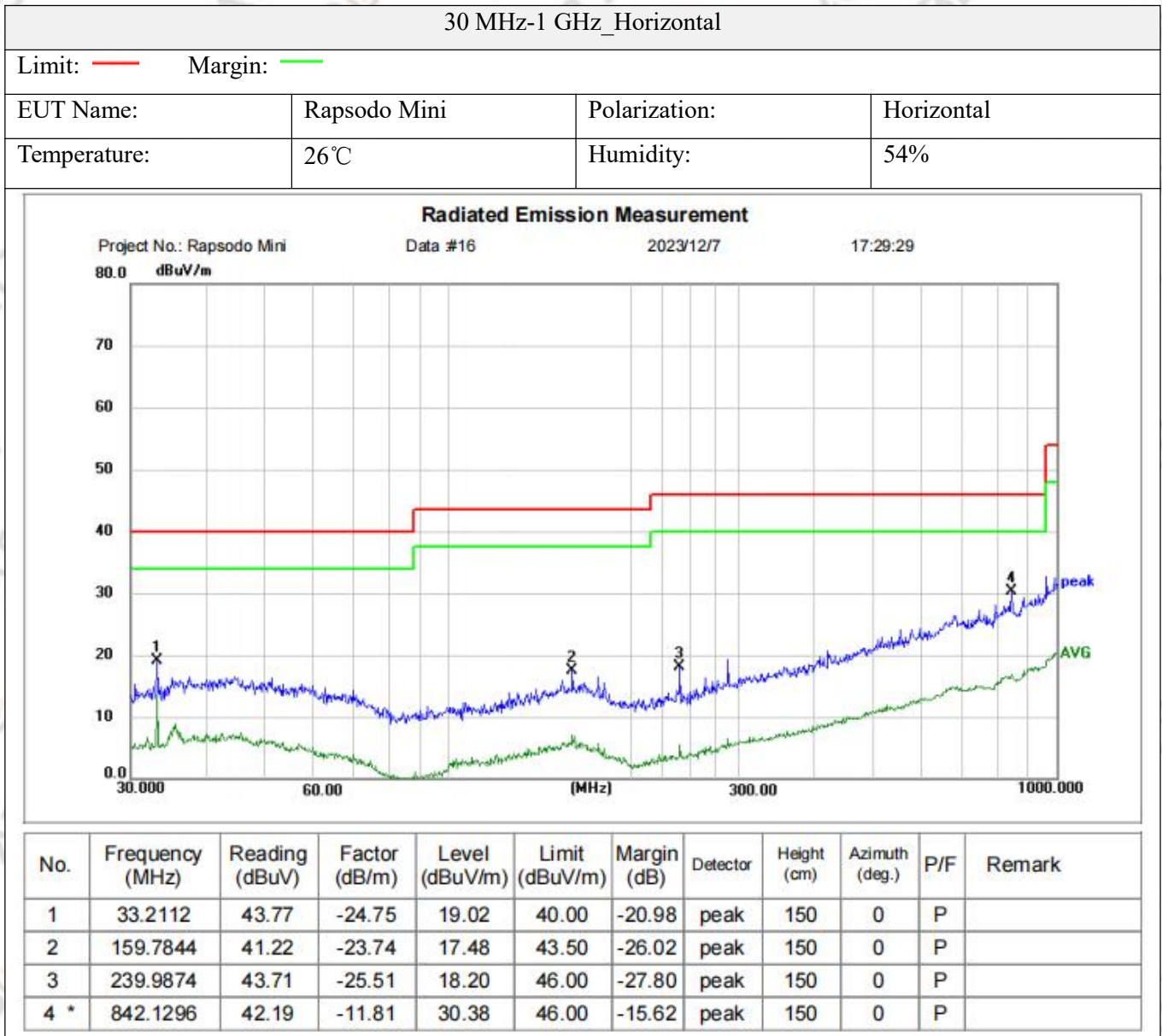
For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



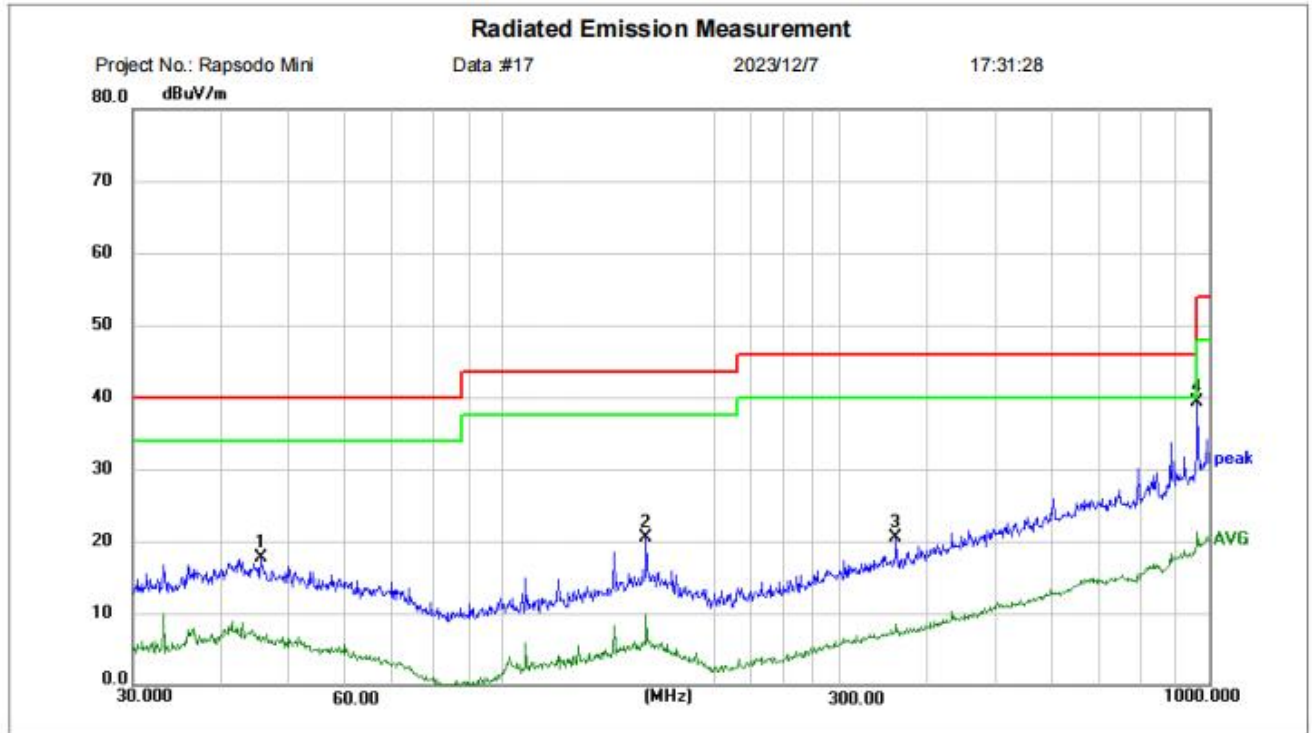
2.4. Test Result of Radiated Spurious Emission



30 MHz-1 GHz_Vertical

Limit: — Margin: —

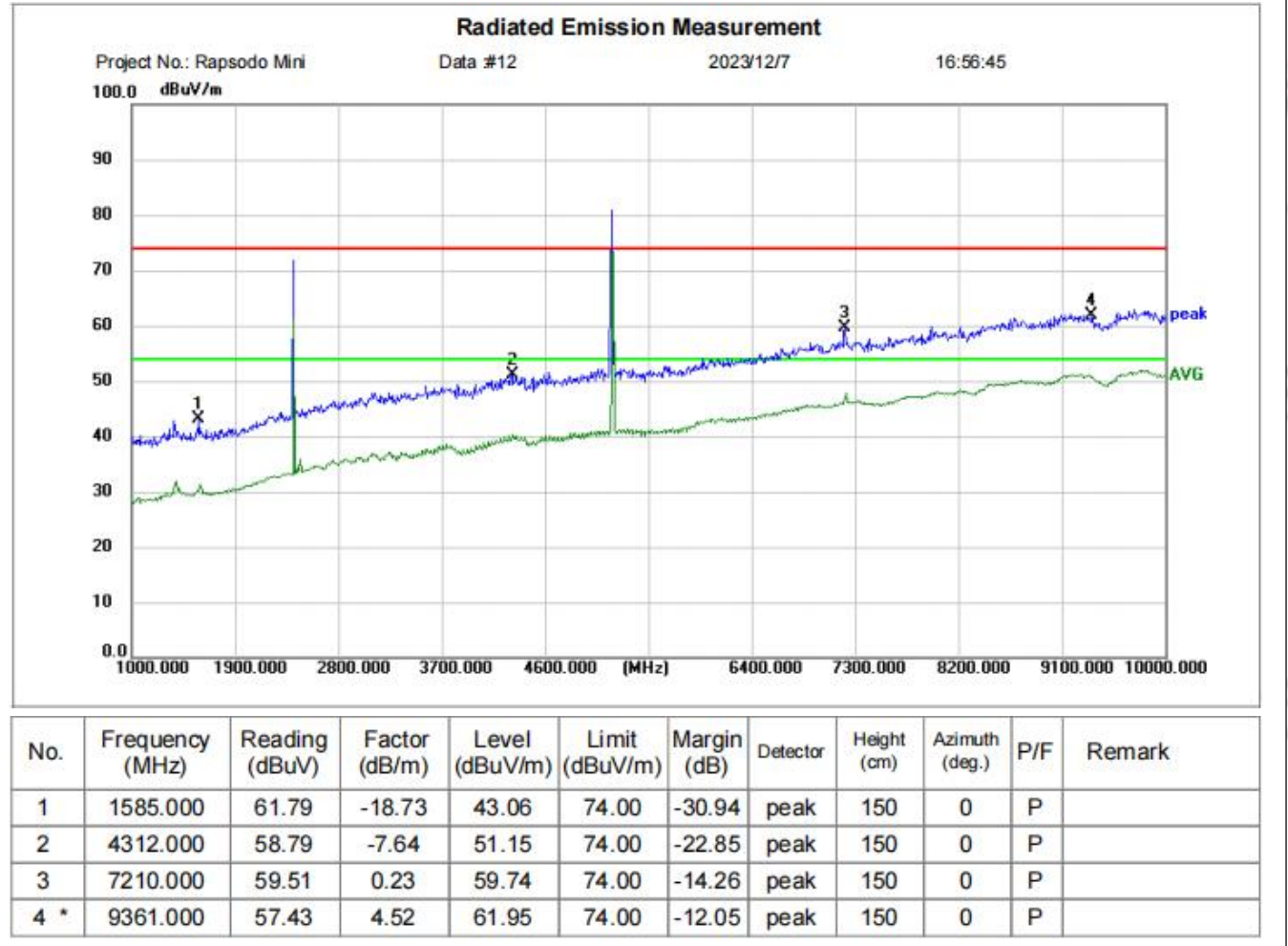
EUT Name:	Rapsodo Mini	Polarization:	Vertical
Temperature:	26°C	Humidity:	54%



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	45.5348	40.73	-23.01	17.72	40.00	-22.28	peak	150	360	P	
2	159.7844	44.32	-23.74	20.58	43.50	-22.92	peak	150	360	P	
3	360.4476	41.92	-21.38	20.54	46.00	-25.46	peak	150	360	P	
4 *	961.4203	48.22	-8.96	39.26	54.00	-14.74	peak	150	360	P	

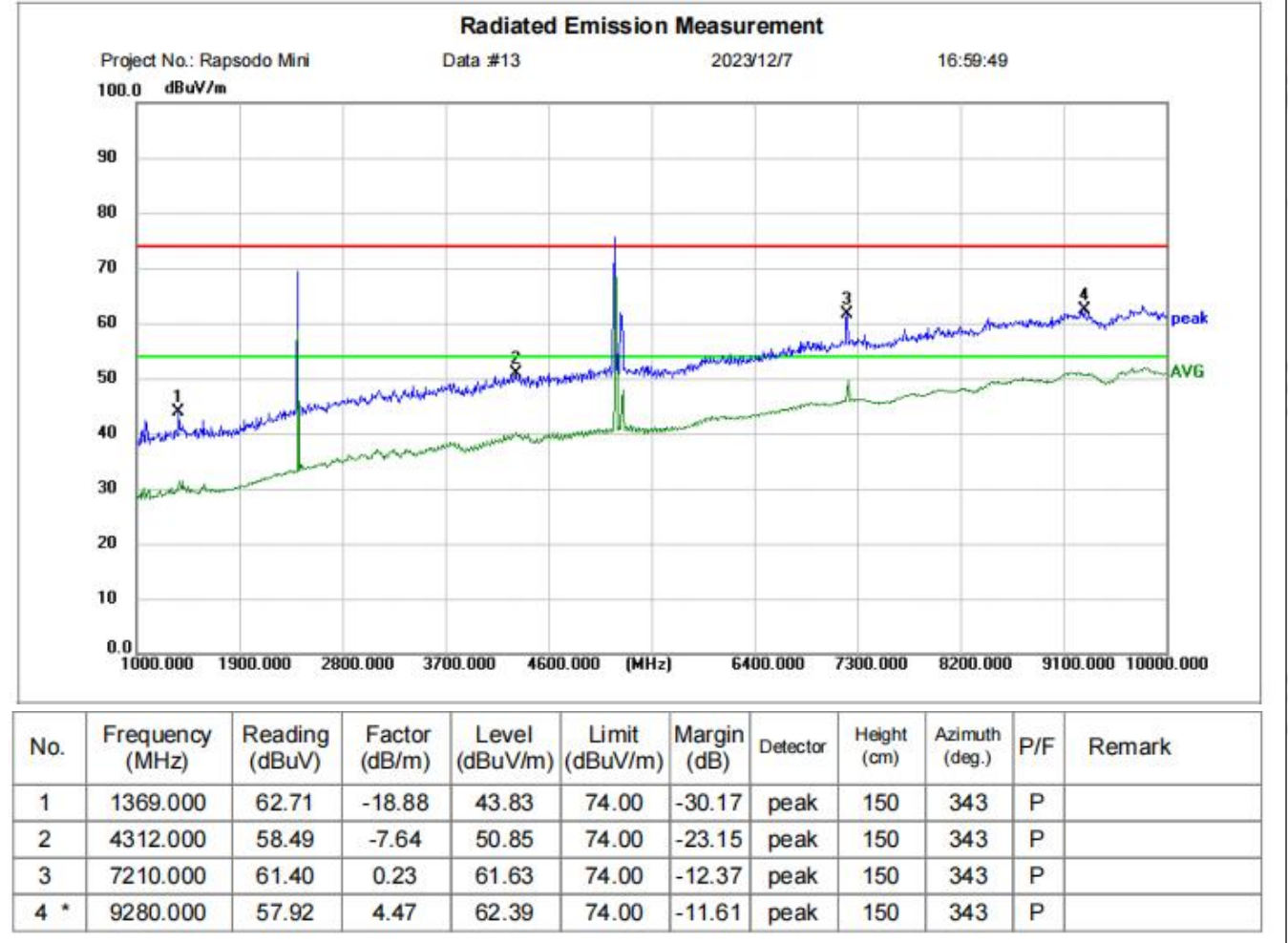
1-10GHz_Horizontal

Peak Limit: —	Average Limit: —		
EUT Name:	Rapsodo Mini	Polarization:	Horizontal
Temperature:	26°C	Humidity:	54%



1-10GHz_Vertical

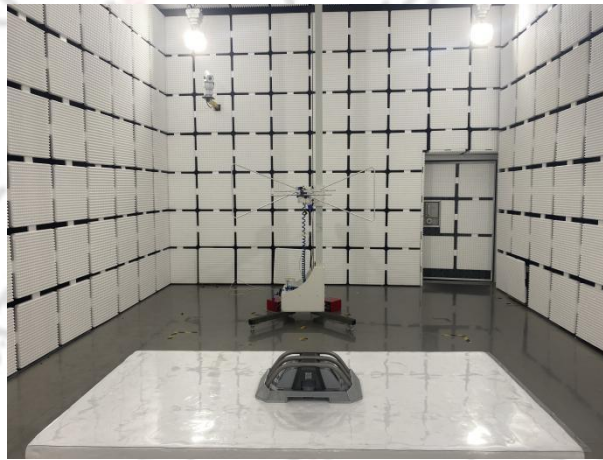
Peak Limit: —	Average Limit: —		
EUT Name:	Rapsodo Mini	Polarization:	Vertical
Temperature:	26°C	Humidity:	54%



10-18GHz _Horizontal									
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F
11268	57.74	8.27	66.01	74	-7.99	Peak	150	360	P
12531	55.97	10.11	66.08	74	-7.92	Peak	150	360	P
13452	54.12	13.16	67.28	74	-6.72	Peak	150	360	P
15621	53.73	15.26	68.99	74	-5.01	Peak	150	360	P
16287	53.81	17.15	70.96	74	-3.04	Peak	150	360	P
17847	54.15	18.03	72.18	74	-1.82	Peak	150	360	P
10-18GHz _Vertical									
Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F
11574	57.84	8.34	66.18	74	-7.82	Peak	150	360	P
12629	56.07	10.19	66.26	74	-7.74	Peak	150	360	P
13651	54.25	13.21	67.46	74	-6.54	Peak	150	360	P
15783	53.81	15.34	69.15	74	-4.85	Peak	150	360	P
16549	53.89	17.24	71.13	74	-2.87	Peak	150	360	P
17813	54.17	17.87	72.04	74	-1.96	Peak	150	360	P

3. Photos OF Test Setup

Radiated Emissions for 30MHz-1GHz



Radiated Emissions for 1GHz-18GHz



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