REPORT No.: SZ24030044W05

TEST REPORT

APPLICANT	:	OnePlus Technology (Shenzhen) Co., Ltd.
PRODUCT NAME	:	Wireless Earbuds
MODEL NAME	:	E512A
BRAND NAME	:	ONEPLUS
FCC ID	:	2ABZ2-E512A
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2024-03-06
TEST DATE	:	2024-03-27 to 2024-04-17
ISSUE DATE	:	2024-08-15

Edited by: Peng Mi (Rapporteur)

Approved by: Shen Junsheng (Supervisor)

MORLAB
Shenzhen Morlab Communications Technology Co., Ltd.
FL.1-3, Building A, FeiYang Science Park, No.8 LongChang Road,
Block67, BaoAn District, ShenZhen , GuangDong Province, P. R. China
Tel: 86-755-36698555 Fax: 86-755-36698525
Http://www.morlab.cn E-mail: service@morlab.cn

DIRECTORY

Change History		
Version	**Date**	**Reason for change**
1.0	2024-08-15	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	OnePlus Technology (Shenzhen) Co., Ltd.
Applicant Address:	18C02, 18C03, 18C04, and 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen, Guangdong, P.R. China
Manufacturer:	OnePlus Technology (Shenzhen) Co., Ltd.
Manufacturer Address:	18C02, 18C03, 18C04, and 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen, Guangdong, P.R. China

1.2. Equipment Under Test (EUT) Description

Product Name:	Wireless Earbuds
Sample No.:	3#,9#
Hardware Version:	X23E3_06
Software Version:	V.2.6
Operating Frequency:	110kHz-205kHz
Modulation Type:	ASK
Antenna Type:	Coil Antenna

Note 1: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

1.3. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15 (10-1-15 Edition)	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Test Date	Test Engineer	Result	Method Determination /Remark
1	15.203	Antenna Requirement	N/A	N/A	PASS	No deviation
2	15.207	Conducted Emission	Mar. 27, 2024 to Apr. 17, 2024	Wang Deyong	PASS	No deviation
3	15.209 15.225(a) (b) (c)(d)	Radiated Emission	Apr. 12, 2024	Yang Lian	PASS	No deviation
4	15.215(c)	20dB Bandwidth	Apr. 12, 2024	Yang Lian	PASS	No deviation

Note 1: The tests were performed according to the method of measurements prescribed in ANSI C63.10-2013. The EUT has been tested under continuous operating condition.

Note 2: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.

Note 3: When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% confidence intervals.

1.4. Environmental Conditions

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

Temperature (°C):	15-35
Relative Humidity (%):	30-60
Atmospheric Pressure (kPa):	86-106

2. 47 CFR Part 15C Requirements

2.1. Antenna Requirement

2.1.1. Applicable Standard

According to FCC 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 shall be considered sufficient to comply with the provisions of this section.

2.1.2. Test Result: Compliant

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

2.2. Conducted Emission

2.2.1. Test Requirement

According to FCC section 15.207, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

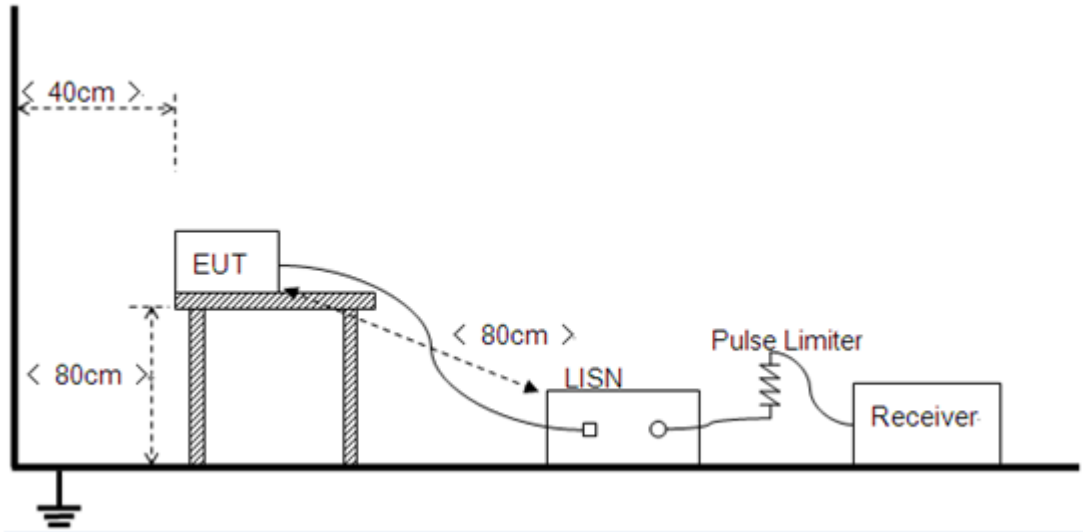
Frequency Range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

(a) The lower limit shall apply at the band edges.

(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.2.2. Test Setup



The EUT is placed on a 0.8m high insulating table, which stands on the grounded conducting floor, and keeps 0.4m away from the grounded conducting wall. The EUT is connected to the power mains through a LISN which provides 50Ω/50μH of coupling impedance for the measuring instrument. A Pulse Limiter is used to protect the measuring instrument. The factors of the whole test system are calibrated to correct the reading.

2.2.3. Test Result

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Set RBW=9kHz, VBW=30kHz. Refer to recorded points and plots below.

Note: Both of the test voltage AC 120V/60Hz and AC 230V/50Hz were considered and tested respectively, only the results of the worst case AC 120V/60Hz were recorded in this report.

A.Test Setup:

Test Mode: EUT+USB+Adapter+Wireless charger+Charging Mode

Test voltage: AC 120V/60Hz

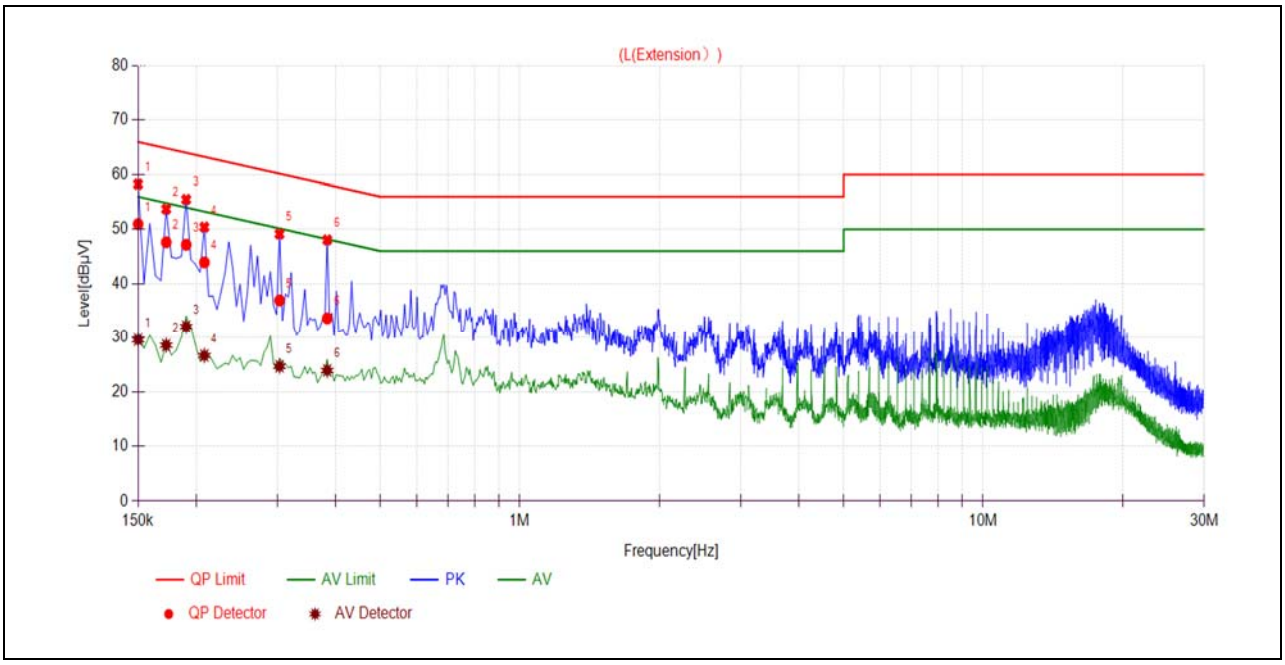
The measurement results are obtained as below:

$E\ [dB\mu V] = U_R + L_{Cable\ loss}\ [dB] + A_{Factor}$

U_R: Receiver Reading

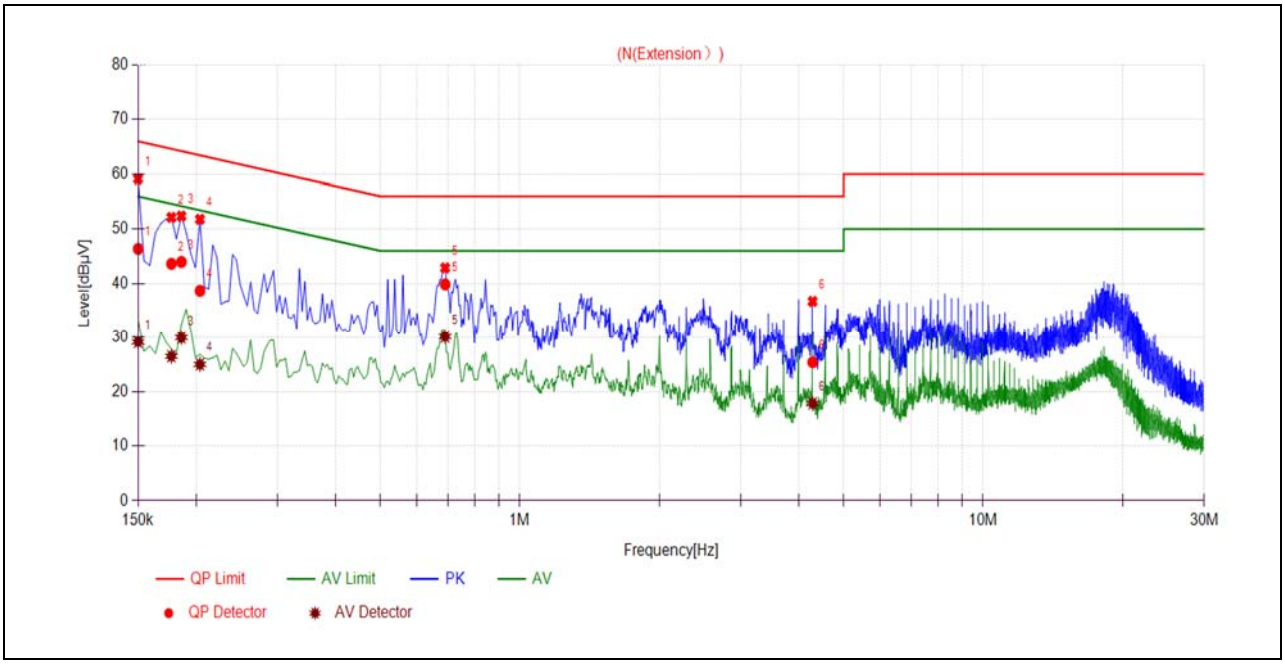
A_{Factor}: Voltage division factor of LISN

B.Test Plot:



(L Phase)

No.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1500	50.98	29.56	66.00	56.00	Line	PASS
2	0.1725	47.64	28.54	64.84	54.84		PASS
3	0.1905	47.18	32.06	64.01	54.01		PASS
4	0.2085	43.93	26.64	63.26	53.26		PASS
5	0.3030	36.92	24.65	60.16	50.16		PASS
6	0.3840	33.60	23.88	58.19	48.19		PASS



(N Phase)

No.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1500	46.37	29.15	66.00	56.00	Neutral	PASS
2	0.1770	43.64	26.49	64.63	54.63		PASS
3	0.1860	43.99	29.97	64.21	54.21		PASS
4	0.2040	38.68	24.99	63.45	53.45		PASS
5	0.6900	39.86	30.15	56.00	46.00		PASS
6	4.2854	25.39	17.80	56.00	46.00		PASS

2.3. Radiated Emission

2.3.1. Test Requirement

Radiated Emission <30MHz (9 kHz-30MHz, E-field)

According to FCC section 15.225, for <30MHz, Radiated emissions were measured according to ANSIC63.4. The EUT was set to transmit at the highest output power. The loop antenna was positioned 1 meter above the ground from the center of the loop. The measuring bandwidth was set to 10KHz. (Note: During testing the receive antenna was rotated about its axis to maximize the emission from the EUT)

There was no detected Restricted bands and Radiated Spurious emission below 30MHz. The 30m or 300m limit was converted to 3m Limit using square factor(x) as it was found by measurements as follows:

For 300m,

3 m Limit(dBuA/m) = 300 m Limit(dBuA/m)+40log(300/3)

For 30m,

3 m Limit(dBuA/m) = 30 m Limit(dBuA/m)+40log(30/3)

Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency range (MHz)	E-Field	E-Field @3m
	μV/m	dBμV/m
0.009 ~ 0.490	2400/F(kHz) @300m	128.5 ~ 93.8
0.490 ~ 1.705	24000/F(kHz) @30m	73.8 ~ 62.9
1.705 ~ 30	30 @30m	69.6

NOTE: a) Field Strength (dBμV/m) = 40*log[Field Strength (μV/m)].

b) In the emission tables above, the tighter limit applies at the band edges.

Radiated Emission >30MHz (30MHz-1GHz, E-field)

According to FCC section 15.205, the field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

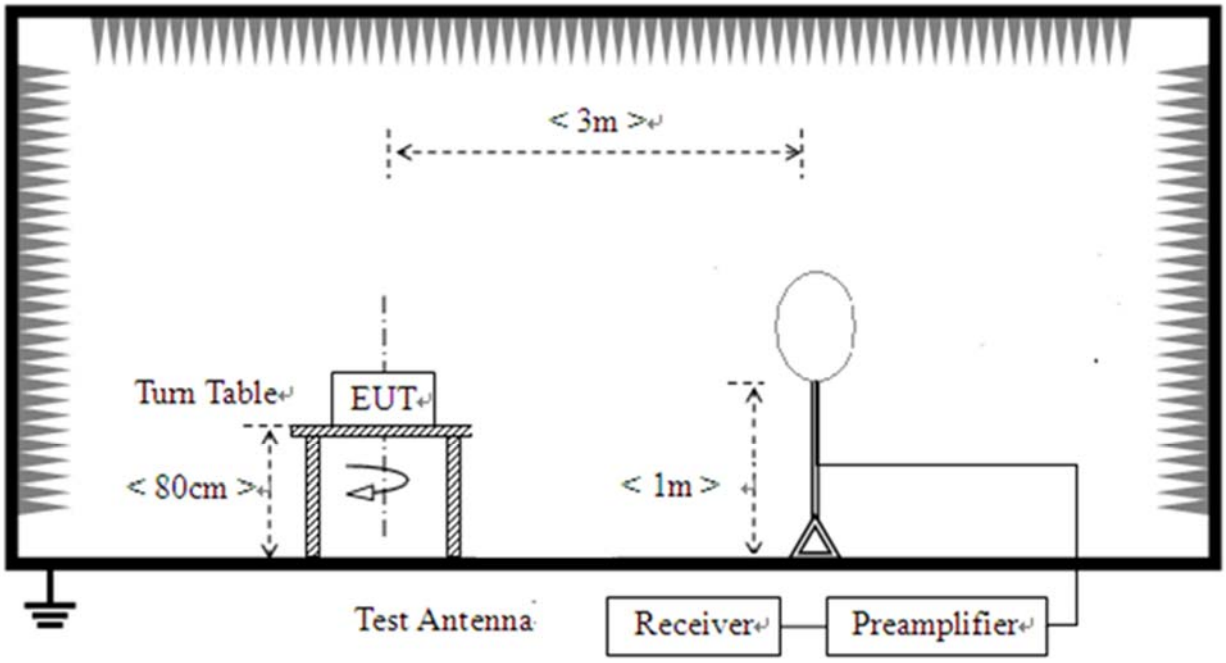
Frequency Range (MHz)	Field Strength	
	μV/m	dBμV/m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

NOTE: a) Field Strength (dBμV/m) = 20*log[Field Strength (μV/m)].

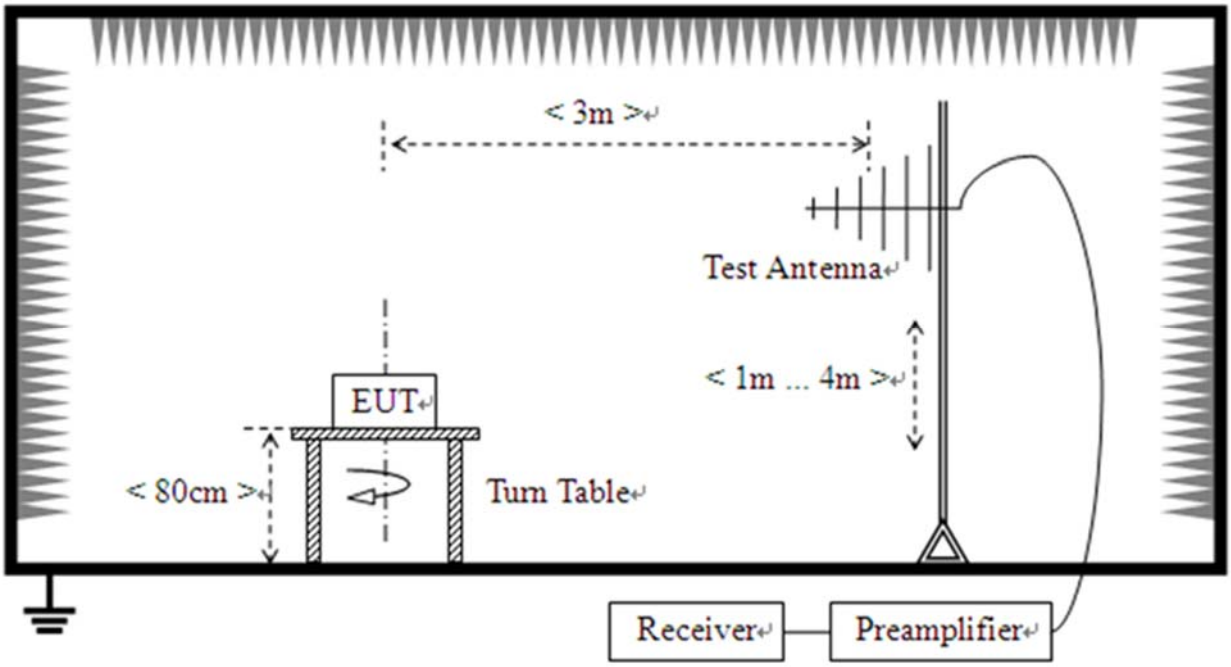
b) In the emission tables above, the tighter limit applies at the band edges.

2.3.2. Test Setup

1) For radiated emissions below 30MHz



2) For radiated emissions from 30MHz to1GHz



The test is performed in a 3m Semi-Anechoic Chamber; the antenna factor, cable loss and so on of the site (factors) is calculated to correct the reading. The EUT is placed on a 0.8m high insulating

Turn Table, and keeps 3m away from the Test Antenna, which is mounted on a variable-height antenna master tower.

For the test Antenna:

In the frequency range of 9 kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.

In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) was used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

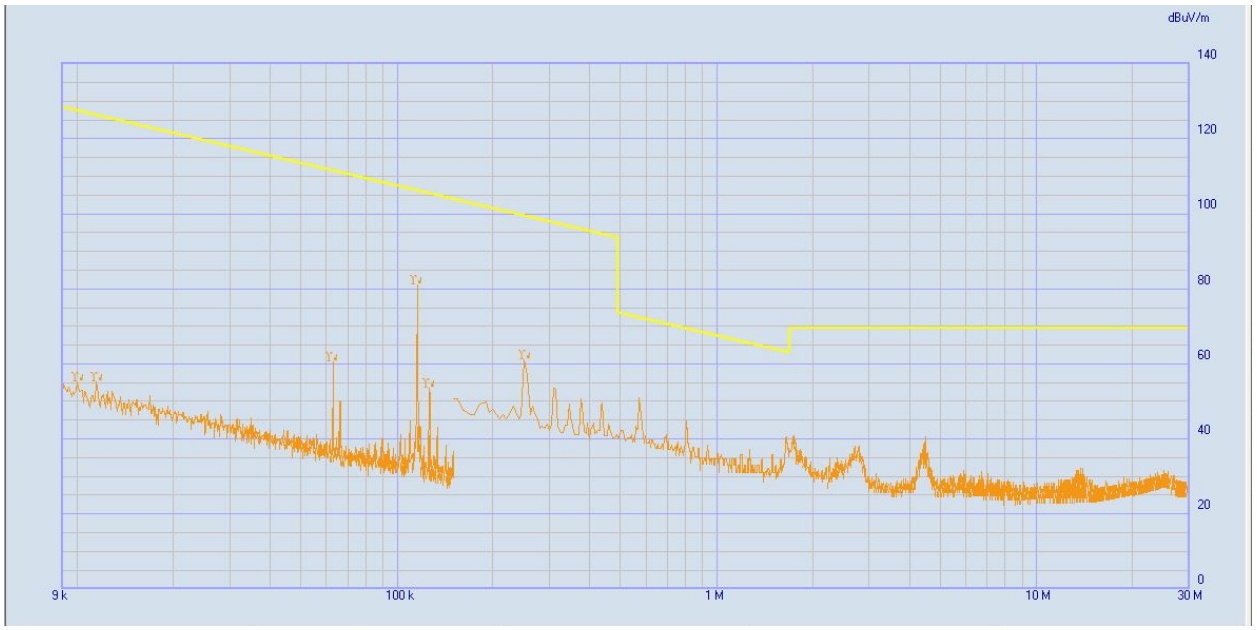
For measurements below 30MHz, the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9kHz-90 kHz, 110kHz-490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector. For measurements frequency range from 0.009MHz to 0.15MHz, the resolution bandwidth is set to 200Hz. For measurements frequency range from 0.15MHz to 30MHz the resolution bandwidth is set to 9kHz.

For measurements below 1GHz the resolution bandwidth is set to 100kHz for peak detection measurements or 120kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1GHz the resolution bandwidth is set to 1MHz, the video bandwidth is set to 3MHz for peak measurements and as applicable for average measurements.

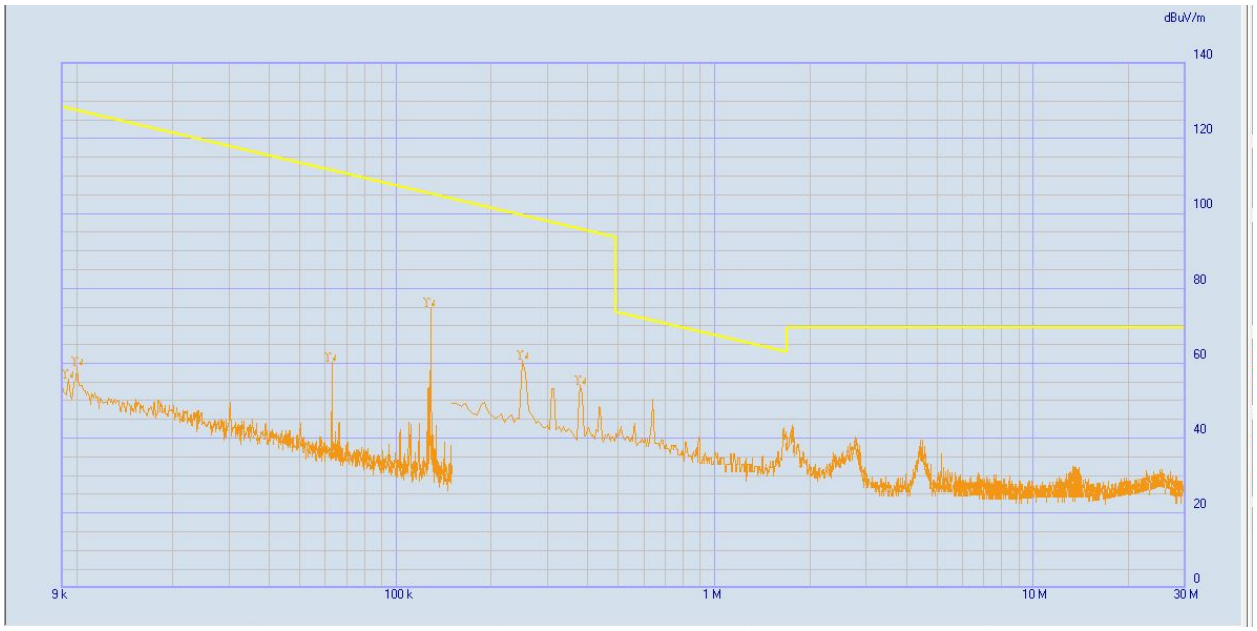
2.3.3. Test Result

A.Radiated Emission <30MHz (9kHz-30MHz, parallel)



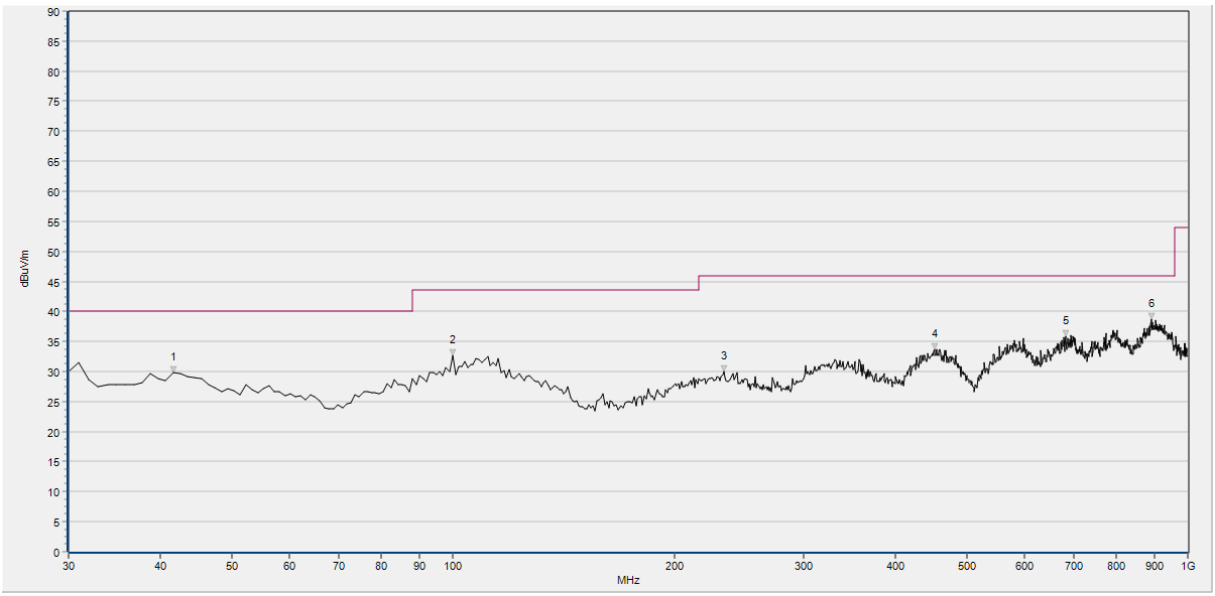
No.	Frequency (MHz)	Detector Type	Level at 3m (dBμV/m)	Limit at 3m (dBμV/m)
1	0.010	Quasi Peak	55.22	127.60
2	0.0115	Quasi Peak	55.08	126.39
3	0.0626	Quasi Peak	60.61	111.67
4	0.1149	Quasi Peak	81.02	106.40
5	0.1252	Quasi Peak	53.58	105.65
6	0.25	Quasi Peak	61.17	99.65

B.Radiated Emission <30MHz (9kHz-30MHz, perpendicular)



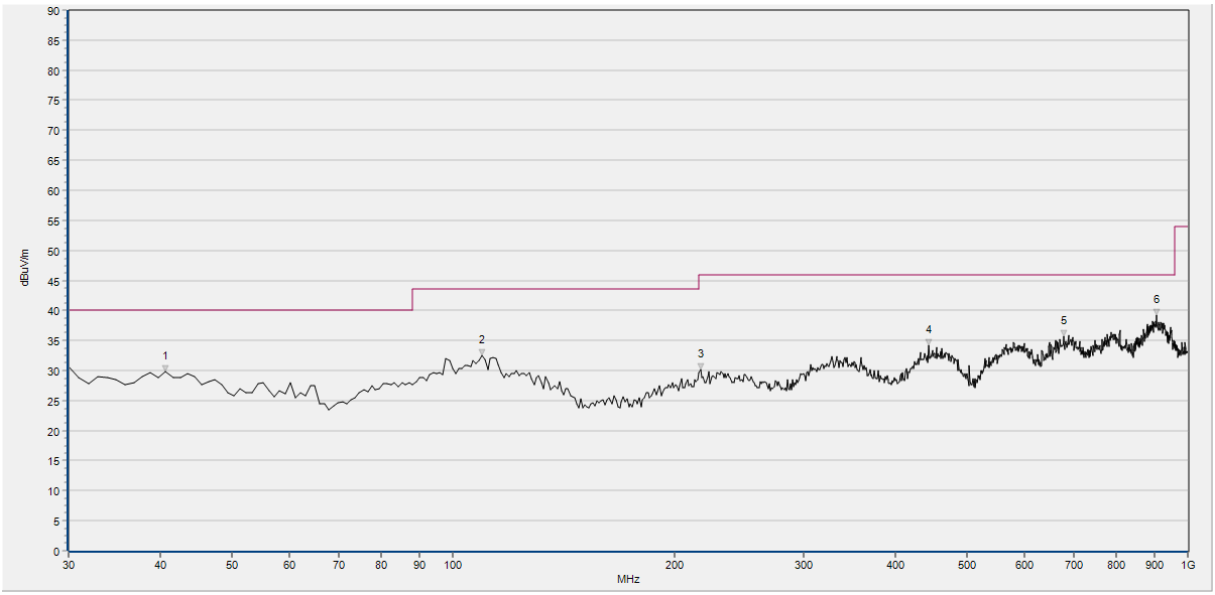
No.	Frequency (MHz)	Detector Type	Level at 3m (dBµV/m)	Limit at 3m (dBµV/m)
1	0.0094	Quasi Peak	55.89	128.14
2	0.01	Quasi Peak	59.13	127.60
3	0.0626	Quasi Peak	60.29	111.67
4	0.128	Quasi Peak	74.92	105.46
5	0.25	Quasi Peak	60.87	99.65
6	0.38	Quasi Peak	53.93	96.01

C.Radiated Emission >30MHz (30MHz-1GHz)



(30MHz – 1GHz, Test Antenna Horizontal)

No.	Fre. MHz	Pk dBμV/m	QP dBμV/m	AV dBμV/m	Limit-PK dBμV/m	Limit-QP dBμV/m	Limit-AV dBμV/m	ANT	Verdict
1	41.640	29.75	N/A	N/A	N/A	40.00	N/A	H	PASS
2	99.840	32.62	N/A	N/A	N/A	43.50	N/A	H	PASS
3	233.700	30.07	N/A	N/A	N/A	46.00	N/A	H	PASS
4	451.950	33.69	N/A	N/A	N/A	46.00	N/A	H	PASS
5	681.840	35.85	N/A	N/A	N/A	46.00	N/A	H	PASS
6	891.360	38.76	N/A	N/A	N/A	46.00	N/A	H	PASS



(30MHz – 1GHz, Test Antenna Vertical)

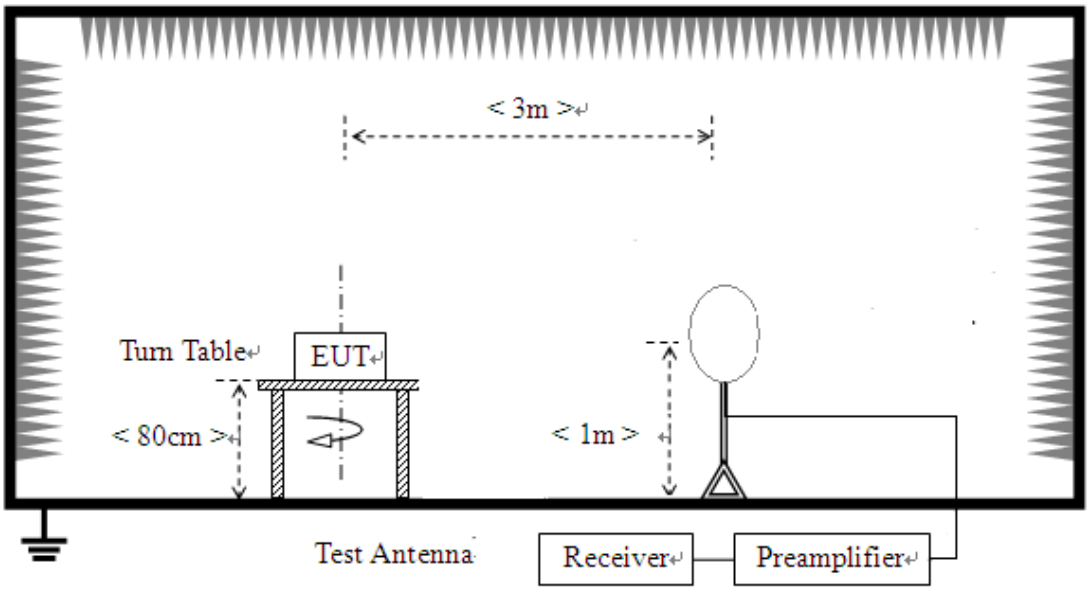
No.	Fre. MHz	Pk dBμV/m	QP dBμV/m	AV dBμV/m	Limit-PK dBμV/m	Limit-QP dBμV/m	Limit-AV dBμV/m	ANT	Verdict
1	40.670	29.77	N/A	N/A	N/A	40.00	N/A	V	PASS
2	109.540	32.46	N/A	N/A	N/A	43.50	N/A	V	PASS
3	217.210	30.11	N/A	N/A	N/A	46.00	N/A	V	PASS
4	444.190	34.24	N/A	N/A	N/A	46.00	N/A	V	PASS
5	677.960	35.70	N/A	N/A	N/A	46.00	N/A	V	PASS
6	906.880	39.18	N/A	N/A	N/A	46.00	N/A	V	PASS

2.4. 20 dB Bandwidth

2.4.1. Standard Applicable

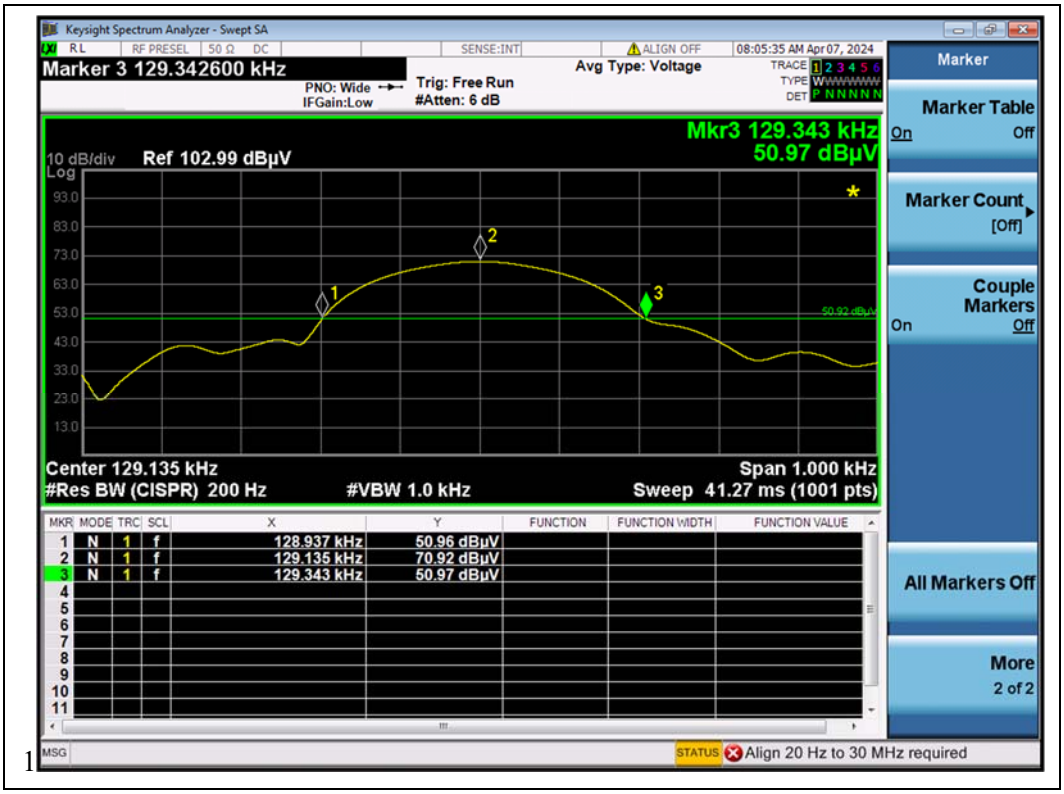
According to FCC section 15.215(c), the 20dB bandwidth should be contained within the frequency band designated in the rule section under which the EUT is operated, it was measured with a spectrum analyzer connected the EUT while the EUT is operating in transmission mode.

2.4.2. Test Setup



2.4.3. Test Result

Frequency(kHz)	20 dB Bandwidth (kHz)	Verdict
110-205kHz	0.406	PASS



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Annex A Test Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

Radiated Emission:	±3.1dB
Conducted Emission:	±1.8dB
Bandwidth:	±5%
Frequency Tolerance:	±5%

Annex B Testing Laboratory Information

1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Laboratory Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

3. Facilities and Accreditations

All measurement facilities used to collect the measurement data are located at FL.3, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10-2013 and CISPR Publication 22; the FCC designation number is CN1192, the test firm registration number is 226174.

4. Test Equipments Utilized

4.1 Test Equipment

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Receiver	MY54130016	N9038A	Agilent	2023.06.21	2024.06.20
Test Antenna - Bi-Log	9163-519	VULB 9163	Schwarzbeck	2023.07.01	2024.06.30
Test Antenna - Loop	1520-022	FMZB1519	Schwarzbeck	2023.06.26	2024.06.25
Anechoic Chamber	N/A	9m*6m*6m	CRT	2022.05.10	2025.05.09

4.2 Conducted Emission Test Equipment

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Receiver	MY56400093	N9038A	KEYSIGHT	2024.01.25	2025.01.24
LISN	8127449	NSLK 8127	Schwarzbeck	2024.02.02	2025.02.01
Pulse Limiter (10dB)	VTSD 9561 F-B #206	VTSD 9561-F	Schwarzbeck	2023.06.27	2024.06.26
RF Coaxial Cable (DC-100MHz)	BNC	MRE04	Qualwave	N/A	N/A

4.3 Test Software Utilized

Model	Software Version	Manufacturer
MORLAB EMCR	Version 1.2	MORLAB
TS+ -[JS32-CE]	Version 2.5.0.0	Tonscend
PMM Emission Suite	Version 2.02	narda

END OF REPORT