



REPORT No.: SZ24070243W01

TEST REPORT

APPLICANT : Ningbo Tromox Technology Co., Ltd.

PRODUCT NAME : NFC Module

MODEL NAME : TDM002Z-09050000

BRAND NAME : TROMOX

FCC ID : 2BAAA-JW01NFC

STANDARD(S) : 47 CFR Part 15 Subpart C

RECEIPT DATE : 2024-08-15

TEST DATE : 2024-09-04 to 2024-09-10

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Change History		
Version	Date	Reason for change
1.0	2024-11-20	First edition



1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Ningbo Tromox Technology Co., Ltd.
Applicant Address:	1st & 2nd Floors, Building 20, No.36 Xingshun Road, Sino-Italy Ningbo Ecological Park, Yuyao, Ningbo, Zhejiang, China
Manufacturer:	Ningbo Tromox Technology Co., Ltd.
Manufacturer Address:	1st & 2nd Floors, Building 20, No.36 Xingshun Road, Sino-Italy Ningbo Ecological Park, Yuyao, Ningbo, Zhejiang, China

1.2. Equipment Under Test (EUT) Description

Product Name:	NFC Module
Sample No.:	3#, 4#
Hardware Version:	V1.2
Software Version:	V0.5
Operating Frequency:	13.56MHz
Modulation Type:	ASK
Antenna Type:	Loop 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	N/A	N/A	N/A ^{Note1}	N/A
3	15.209 15.225(a) (b) (c)(d)	Radiated Emission	Sep. 04, 2024	Li Hanbin	PASS	No deviation
4	15.225(e)	Frequency Tolerance	Sep. 04, 2024	Su Xiaoxian	PASS	No deviation
5	15.215(c)	20dB Bandwidth	Sep. 10, 2024	Li Hanbin	PASS	No deviation

Note 1: Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.

Note 2: 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 3: 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 4: 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. Radiated Emission

2.2.1. 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 EUT was set 30 meter away from the measuring antenna. 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 limit was converted to 3m Limit using square factor(x) as it was found by measurements as follows;

$$3 \text{ m Limit(dBuV/m)} = 20\log(X)+40\log(30/3)= 20\log(15848)+40\log(30/3) = 124\text{dBuV}$$

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)	Field Strength@30m		Field Strength@3m
	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$
Below 13.110	30	29.5	69.5
13.110 ~ 13.410	106	40.5	80.5
13.410 ~ 13.553	334	50.5	90.5
13.553 ~13.567	15.848	84	124
13.567 ~ 13.710	334	50.5	90.5
13.710 ~14.010	106	40.5	80.5
Above 14.010	30	29.5	69.5

NOTE: a) Field Strength ($\text{dB}\mu\text{V/m}$) = $20*\log[\text{Field Strength } (\mu\text{V/m})]$.

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:

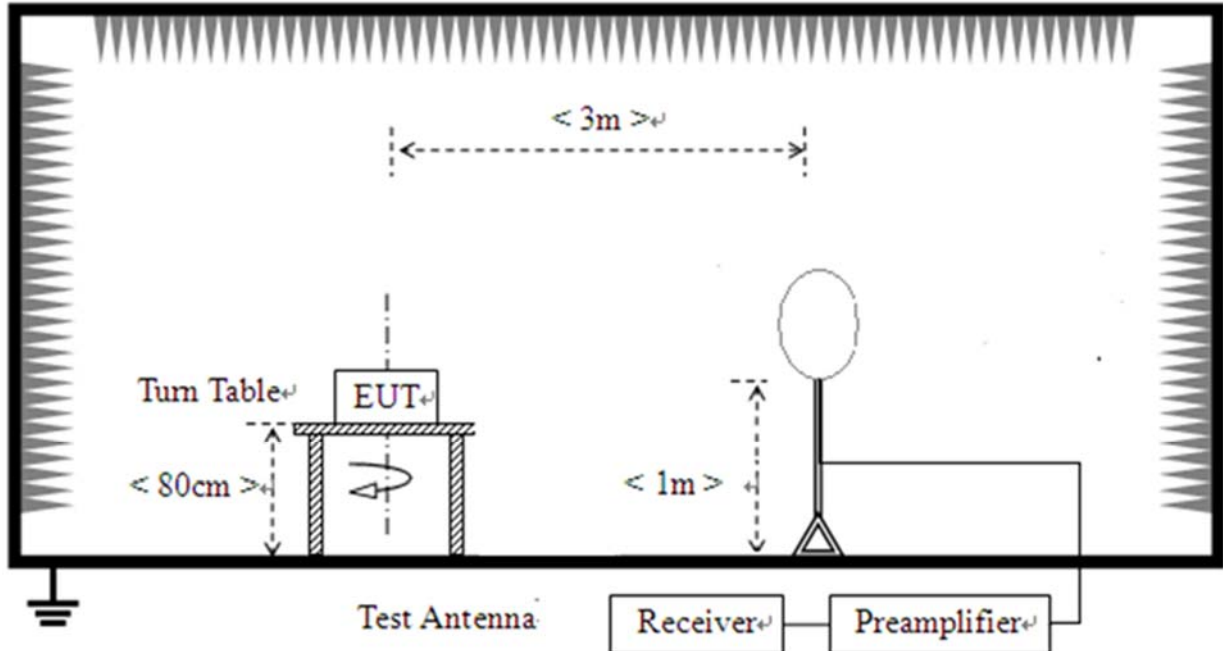
Frequency Range (MHz)	Field Strength	
	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

NOTE: a) Field Strength ($\text{dB}\mu\text{V/m}$) = $20*\log[\text{Field Strength } (\mu\text{V/m})]$.

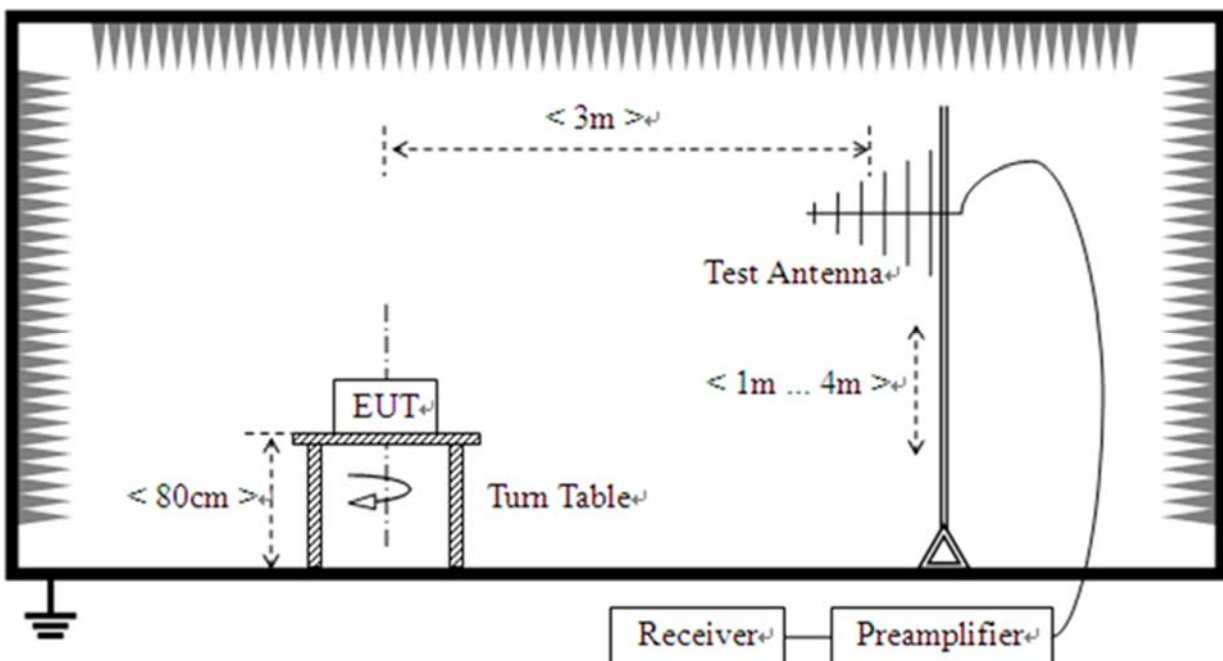
b) In the emission tables above, the tighter limit applies at the band edges.

2.2.2. Test Setup

1) For radiated emissions below 30MHz



2) For radiated emissions from 30MHz to 1GHz



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.

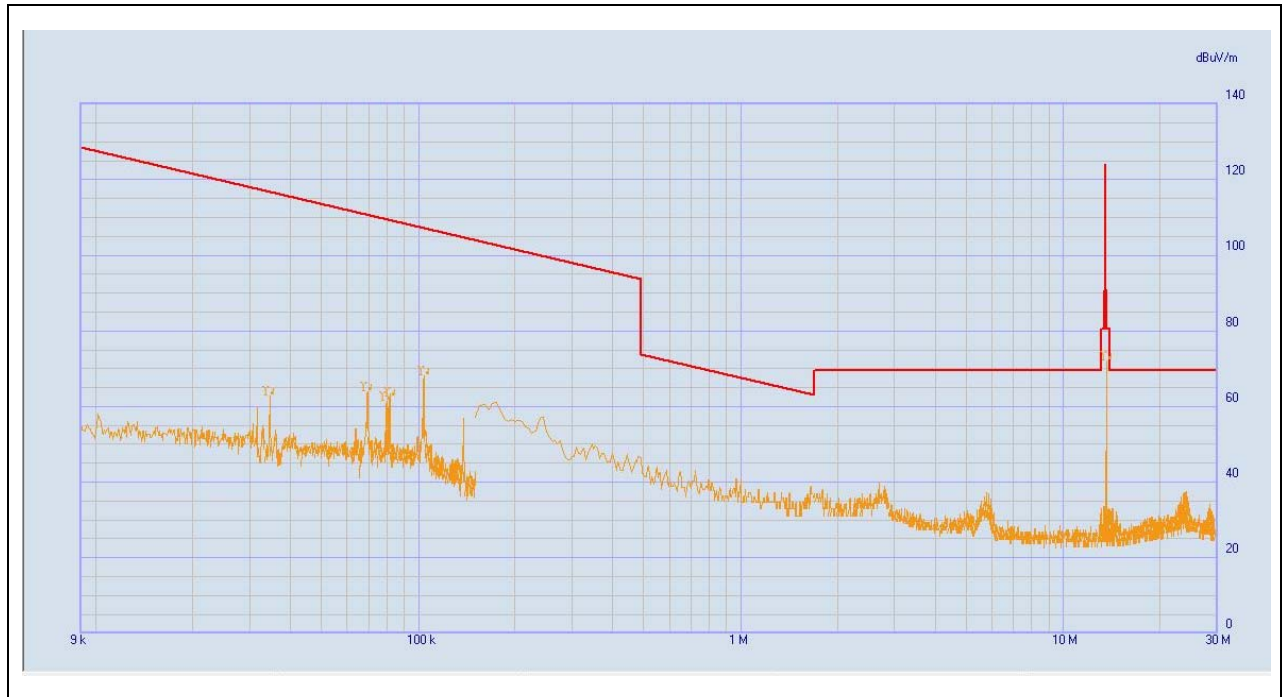
For measurements below 30MHz, the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9kHz-90 kHz, 110kHz-490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector. For 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.

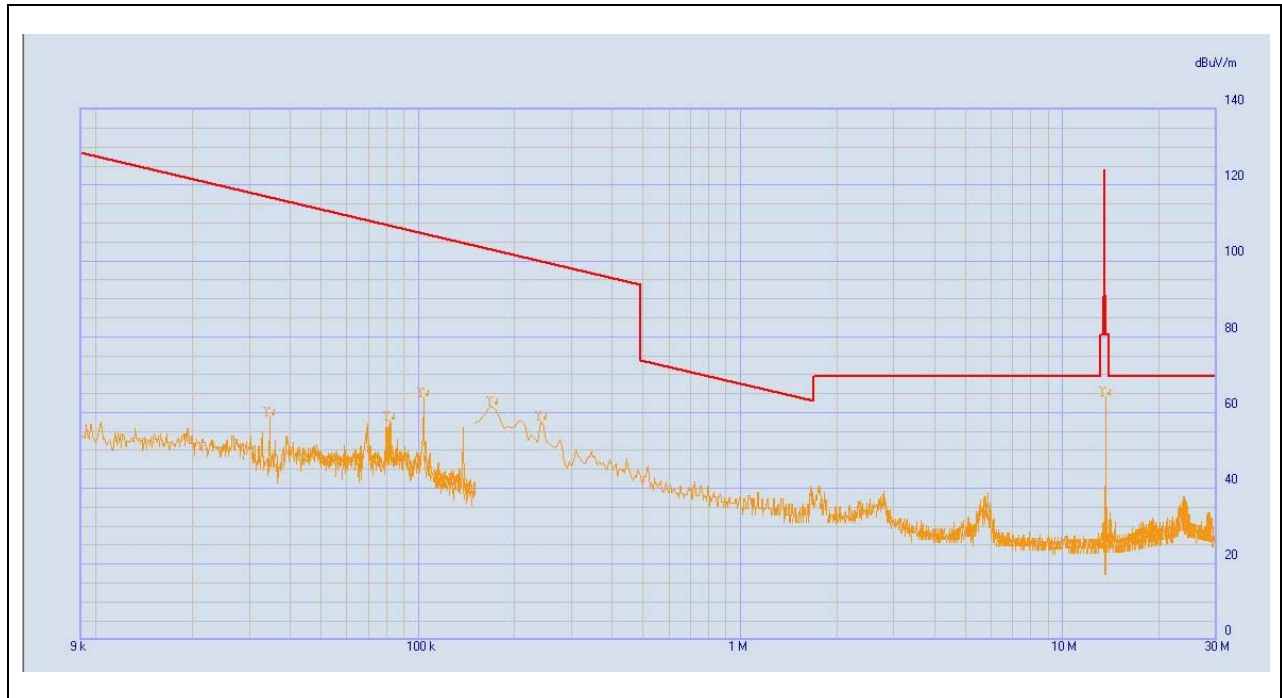
2.2.3. Test Result

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



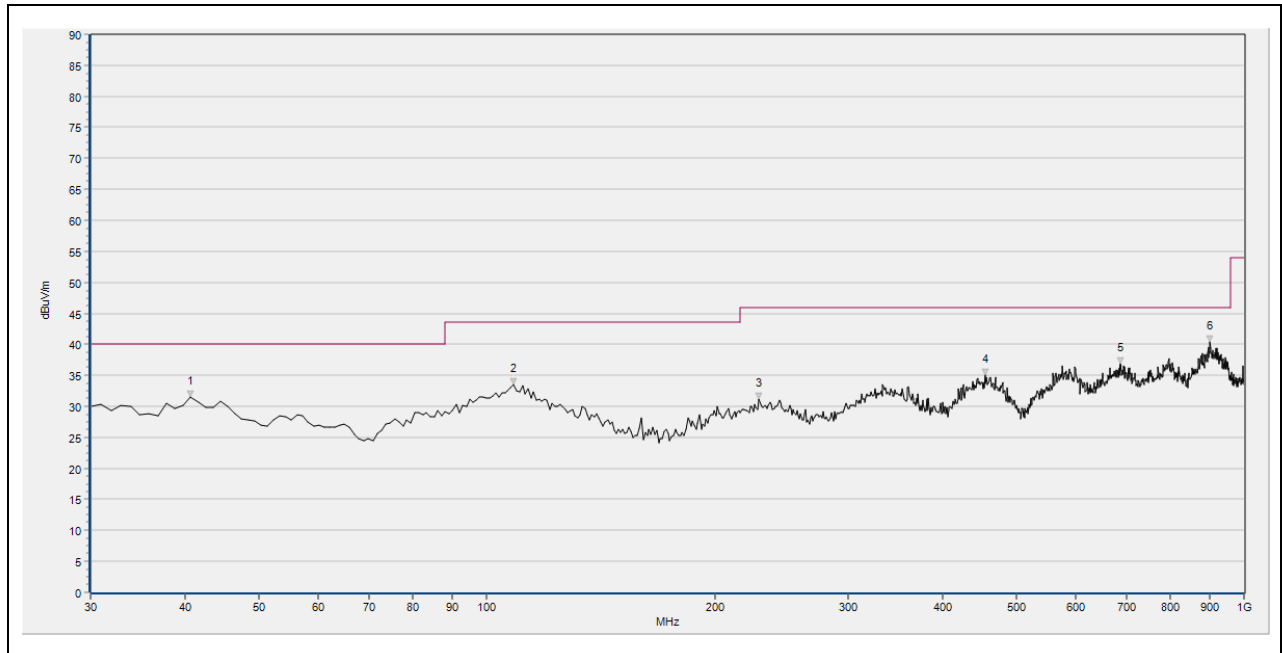
No.	Frequency (MHz)	Detector Type	Level at 3m (dBμV/m)	Limit at 3m (dBμV/m)
1	0.034	Quasi Peak	62.82	116.97
2	0.069	Quasi Peak	63.93	110.83
3	0.079	Quasi Peak	61.26	109.65
4	0.081	Quasi Peak	62.50	109.43
5	0.103	Quasi Peak	68.05	107.35
6	13.56	Quasi Peak	72.11	124.0

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



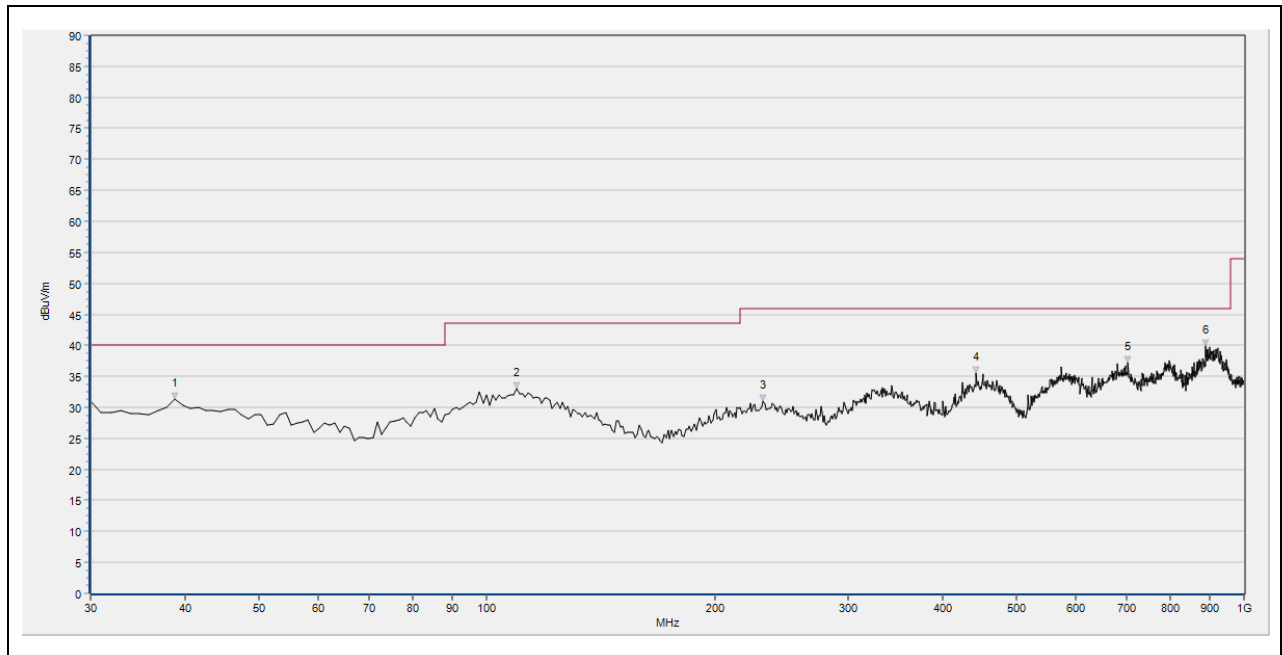
No.	Frequency (MHz)	Detector Type	Level at 3m (dBμV/m)	Limit at 3m (dBμV/m)
1	0.035	Quasi Peak	58.83	116.72
2	0.081	Quasi Peak	57.71	109.43
3	0.103	Quasi Peak	63.94	107.35
4	0.170	Quasi Peak	61.57	103.00
5	0.240	Quasi Peak	57.60	100.00
6	13.56	Quasi Peak	64.31	124.0

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	40.670	31.46	N/A	N/A	N/A	40.00	N/A	H	PASS
2	108.570	33.55	N/A	N/A	N/A	43.50	N/A	H	PASS
3	228.850	31.21	N/A	N/A	N/A	46.00	N/A	H	PASS
4	454.860	34.96	N/A	N/A	N/A	46.00	N/A	H	PASS
5	687.660	36.82	N/A	N/A	N/A	46.00	N/A	H	PASS
6	902.030	40.38	N/A	N/A	N/A	46.00	N/A	H	PASS



(30MHz – 1GHz, Test Antenna Vertical)

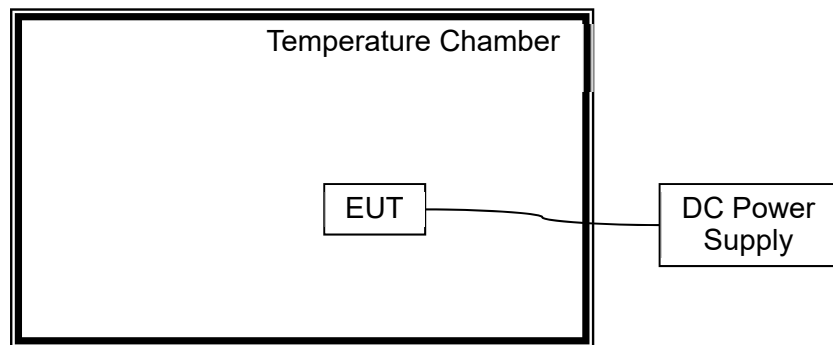
No.	Fre. MHz	Pk dBμV/m	QP dBμV/m	AV dBμV/m	Limit-PK dBμV/m	Limit-QP dBμV/m	Limit-AV dBμV/m	ANT	Verdict
1	38.730	31.32	N/A	N/A	N/A	40.00	N/A	V	PASS
2	109.540	33.02	N/A	N/A	N/A	43.50	N/A	V	PASS
3	231.760	31.04	N/A	N/A	N/A	46.00	N/A	V	PASS
4	443.220	35.47	N/A	N/A	N/A	46.00	N/A	V	PASS
5	702.210	37.18	N/A	N/A	N/A	46.00	N/A	V	PASS
6	889.420	39.82	N/A	N/A	N/A	46.00	N/A	V	PASS

2.3. Frequency Tolerance

2.3.1. Test Requirement

According to FCC section 15.225, the devices operating in the 13.553~13.567 MHz shall maintain the carrier frequency within 0.01% of the operating frequency over the temperature variation of -20°C to +50°C using an environmental chamber. The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

2.3.2. Test Setup



The EUT, which is powered by the DC Power Supply directly, is located in the Temperature Chamber. The EUT was measured by transmitter mode continuously.

**2.3.3. Test Result**

Operating Frequency: 13,560,000 Hz

Deference Voltage: 72V

Deviant Limit: $\pm 0.01\%$

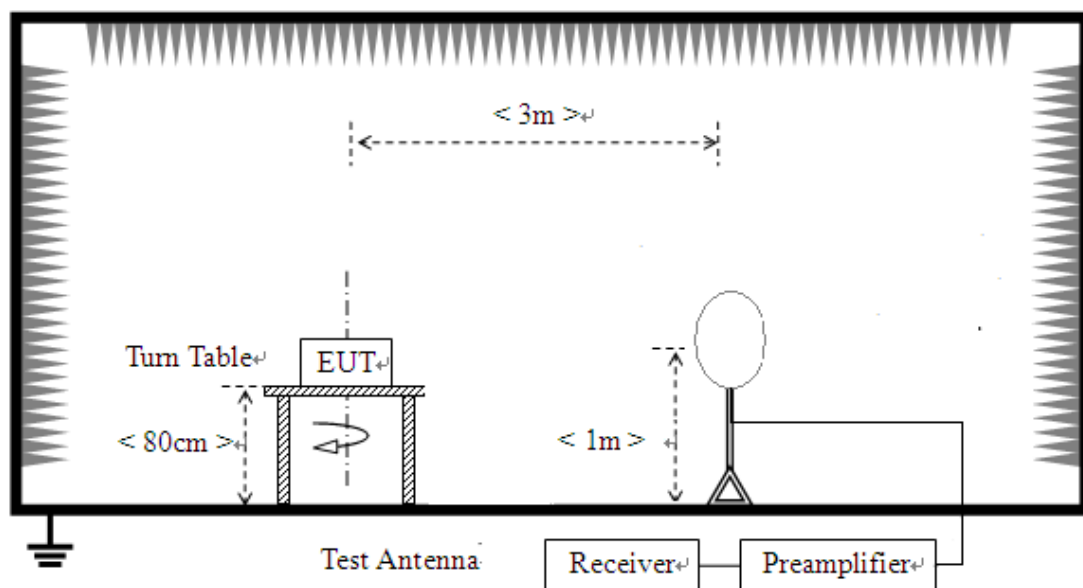
VOLTAGE (%)	Test Conditions		Fre. Dev. (Hz)	Deviation (%)	Verdict
	Power (VDC)	Temperature (°C)			
100	72	-30	288	0.00212	PASS
100		-20	284	0.00209	
100		-10	279	0.00206	
100		0	282	0.00208	
100		10	273	0.00201	
100		20	256	0.00189	
100		25	247	0.00182	
100		30	255	0.00188	
100		40	260	0.00192	
100		50	288	0.00212	
100		60	280	0.00206	
100		70	289	0.00213	
85	12	20	288	0.00212	
115	100	20	292	0.00215	

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.

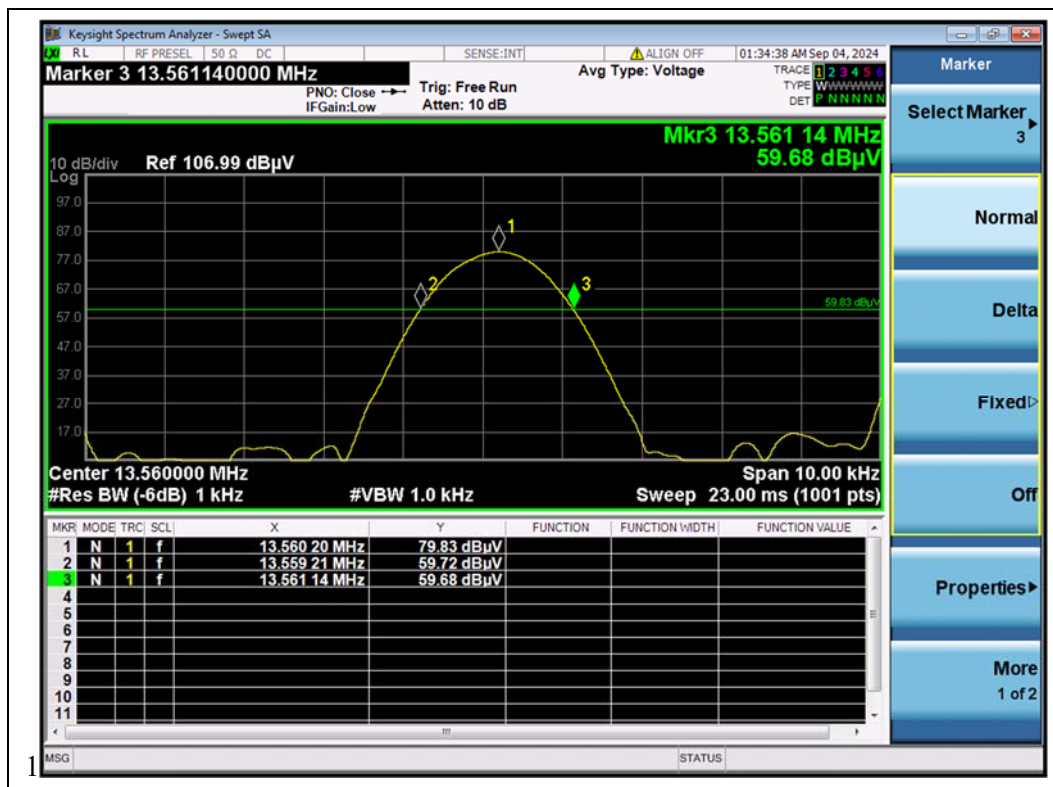
2.4.2. Test Setup





2.4.3. Test Result

Centre Frequency	Measurement		Limit		Verdict
	20 dB Bandwidth (kHz)	Frequency Range (MHz)	20dB Bandwidth (kHz)	Frequency Range(MHz)	
13.56MHz	1.93	13. 55921 to 13.56114	14	13.553 to 13.567	PASS





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.

Test Items	Uncertainty
Radiated Emission	$\pm 3.1\text{dB}$
Conducted Emission	$\pm 1.8\text{dB}$
Bandwidth	$\pm 5\%$
Frequency Tolerance	$\pm 5\%$



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 Equipment Utilized

4.1 Radiated Test Equipment

Equipment	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Signal Analyzer	MY56060145	N9020A	Agilent	2024.05.30	2025.05.29
Test Antenna - Bi-Log	9163-519	VULB 9163	Schwarzbeck	2024.06.22	2025.06.21
Test Antenna - Loop	1519-022	FMZB1519	Schwarzbeck	2024.06.03	2025.06.02
Anechoic Chamber	N/A	9m*6m*6m	CRT	2022.05.10	2025.05.09
DC Power Supply	1709D361010	IV3610	IVYTECH	2023.09.19	2024.09.18
Temperature Chamber	12108015	DTL-003S101	YOMA	2023.09.19	2024.09.18

4.2 Conducted Emission Test Equipment

Equipment	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	2024.05.30	2025.05.29
RF Coaxial Cable (DC-100MHz)	BNC	MRE04	Qualwave	2024.07.02	2025.07.01

4.3 Test Software Utilized

Description	Manufacturer	Software Version
Morlab EMCR	Morlab	V1.2
TS+ -[JS32-CE]	Tonscend	V2.5.0.0
PMM Emission Suite	narda	Version 2.02

_____ END OF REPORT _____