

FCC- TEST REPORT

Report Number : **709502302193-00B** Date of Issue: April 12, 2023

Model : KC-109D

Product Type : Multi-function Detector

Applicant : NDI TOOLS LLC

Address : 733 Ehrhorn Avenue Mountain View California 94041 United States

Production Facility : Yancheng Kecheng Optoelectronic Technology Co., Ltd

Address : NO.43 Taihu Road,Tinghu District,Yancheng City,Jiangsu China

Test Result : ☒ **Positive** ☐ **Negative**

Total pages including
Appendices : 17



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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
No.16 Lane, 1951 Du Hui Road,
Shanghai 201108,
P.R. China

Test Firm FCC
Registration
Number: 820234

Designation
number: CN1183

IC Company
Number: 25988

CAB identifier: CN0101

Telephone: +86 21 6141 0123
Fax: +86 21 6140 8600

3 Description of the Equipment Under Test

Product:	Multi-function Detector
Model no.:	KC-109D
FCC ID:	2BANG109D
IC:	N/A
Rating:	Internal Power Supply:DC 4.5V (3*AAA battery)
RF Transmission Frequency:	Metal:5KHz $\pm$ 1KHz; Stud:1MHz $\pm$ 0.3MHz
Antenna Type:	Probe electrode
Description of the EUT:	The EUT was a Multi-function Detector which transmitter operated at 5KHz $\pm$ 1KHz and 1MHz $\pm$ 0.3MHz. This report is only for 1MHz $\pm$ 0.3MHz.
Test sample no.:	SHA-721330-1

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to ANSI C63.10-2013.

5 Summary of Test Results

Technical Requirements				
FCC Part 15 Subpart C				
Test Condition		Pages	Test Site	Test Result
§15.205, §15.209	Radiated Emission, 9KHz to 1000MHz	10-15	Test Site 1	Pass
§15.215	20dB Bandwidth	16	Test Site 1	Pass
§15.203	Antenna requirement	--	See Note 1	Pass

Note 1: The EUT uses probe electrode Antenna (45*54mm refer to internal photo). In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID:2BANG109D complies with Section 15.205, 15.209, 15.215 of the FCC Part 15, Subpart C Rules.

SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

□ - **Not** Performed

The Equipment Under Test

■ - **Fulfills** the general approval requirements.

□ - **Does not** fulfill the general approval requirements.

Sample Received Date: April 3, 2023

Testing Start Date: April 6, 2023

Testing End Date: April 11, 2023

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Reviewed by:

Prepared by:

Tested by:



Hui TONG
EMC Section Manager



Jiaxi XU
EMC Project Engineer



Cheng Huali
EMC Test Engineer

7 Systems test configuration

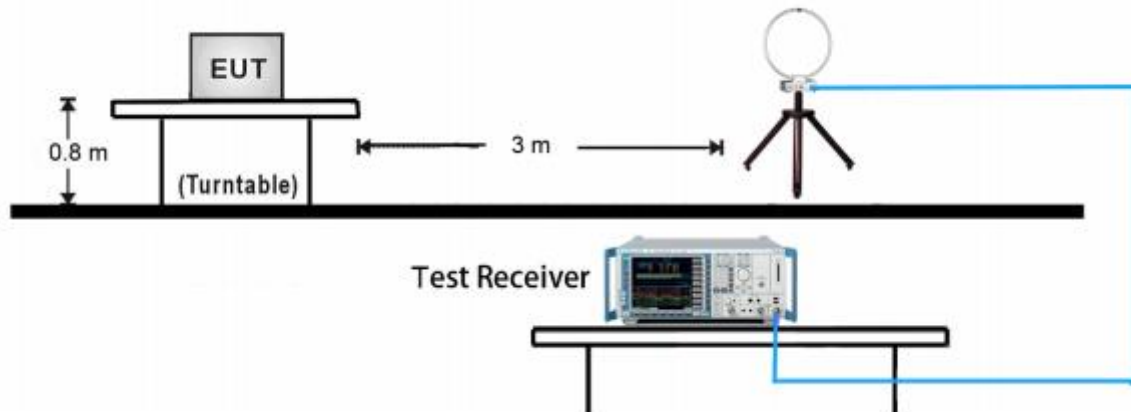
Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
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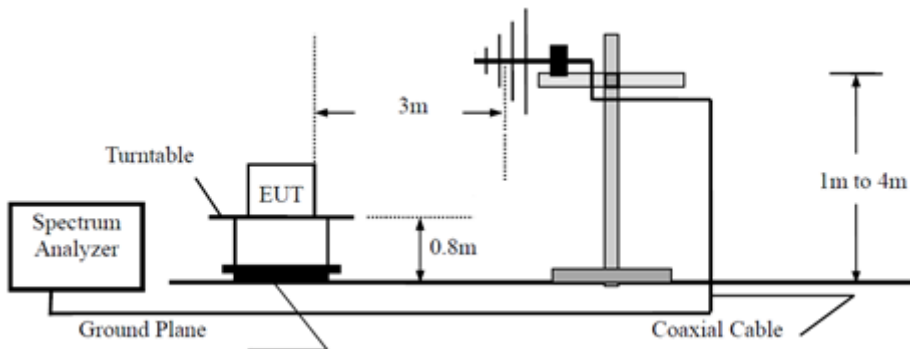
8 Test Setups

8.1 Radiated test setups

9kHz ~ 30MHz Test Setup:



30MHz ~ 1GHz Test- Setup



9 Test Methodology

9.1 Radiated Emission

Test Method

1. The EUT was placed on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meters chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
4. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
5. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
6. Use the following spectrum analyzer settings According to C63.10:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for $f < 1$ GHz; VBW RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement.For average measurement:
VBW = 10 Hz, when duty cycle is no less than 98 percent.
VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
7. Repeat above procedures until all frequencies measured were complete.

Limits for 15.209 Radiated emission limits; general requirements

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

Frequency	Limit at 3m (dBuV/m)
0.009 MHz – 0.490 MHz	128.5 to 93.8 ¹
0.490 MHz – 1.705 MHz	73.8 to 63 ¹
1.705 MHz – 30 MHz	69.5 ¹
30 MHz – 88 MHz	40.0 ¹
88 MHz – 216 MHz	43.5 ¹
216 MHz – 960 MHz	46.0 ¹
Above 960 MHz	54.0 ¹
Above 1000 MHz	54.0 ²
Above 1000 MHz	74.0 ³

¹Limit is with detector with bandwidths as defined in CISPR-16-1-1 except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz where an Average detector is used.

²Limit is with 1 MHz measurement bandwidth and using an Average detector

³Limit is with 1 MHz measurement bandwidth and using a Peak detector

Spurious radiated emissions for transmitter

Pre-scan with three orthogonal axis and worst case as X axis (30-1000MHz). The only worse case test result is listed in the report.

30-1000MHz Radiated Emission

EUT Information

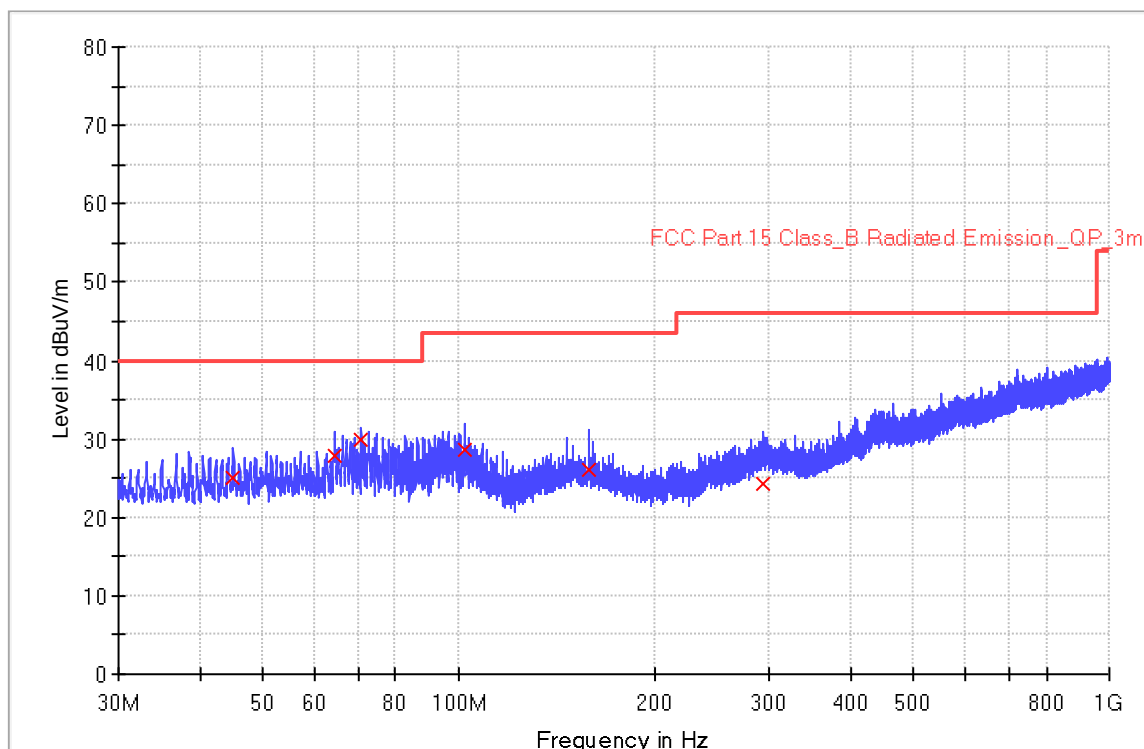
EUT Name:	Multi-function Detector
Model:	KC-109D
Client:	NDI TOOLS LLC
Op Cond:	Power on, DC 4.5V, T21.3, H50.7%, P103.0kPa
Operator:	Cheng Huali
Test Spec:	FCC 15.209(a)
Comment:	Horizontal
Sample No:	SHA-721330-1

Sweep Setup: RE_VULB9168_pre_Cont_30-1000 [EMI radiated]

Hardware Setup:	RE_VULB9168
Receiver:	[ESR 3]
Level Unit:	dBuV/m

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48.5 kHz	PK+	120 kHz	0.2 s	20 dB

RE_VULB9168_pre_Cont_30-1000



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
45.040000	25.1	1000.0	120.000	215.0	H	314.0	20.3	14.9	40.0
64.480000	27.8	1000.0	120.000	175.0	H	201.0	19.5	12.2	40.0
70.920000	30.0	1000.0	120.000	159.0	H	95.0	18.4	10.0	40.0
102.160000	28.6	1000.0	120.000	215.0	H	136.0	16.3	14.9	43.5
158.240000	26.1	1000.0	120.000	136.0	H	221.0	20.9	17.4	43.5
294.480000	24.3	1000.0	120.000	169.0	H	52.0	21.3	21.7	46.0

30-1000MHz Radiated Emission

EUT Information

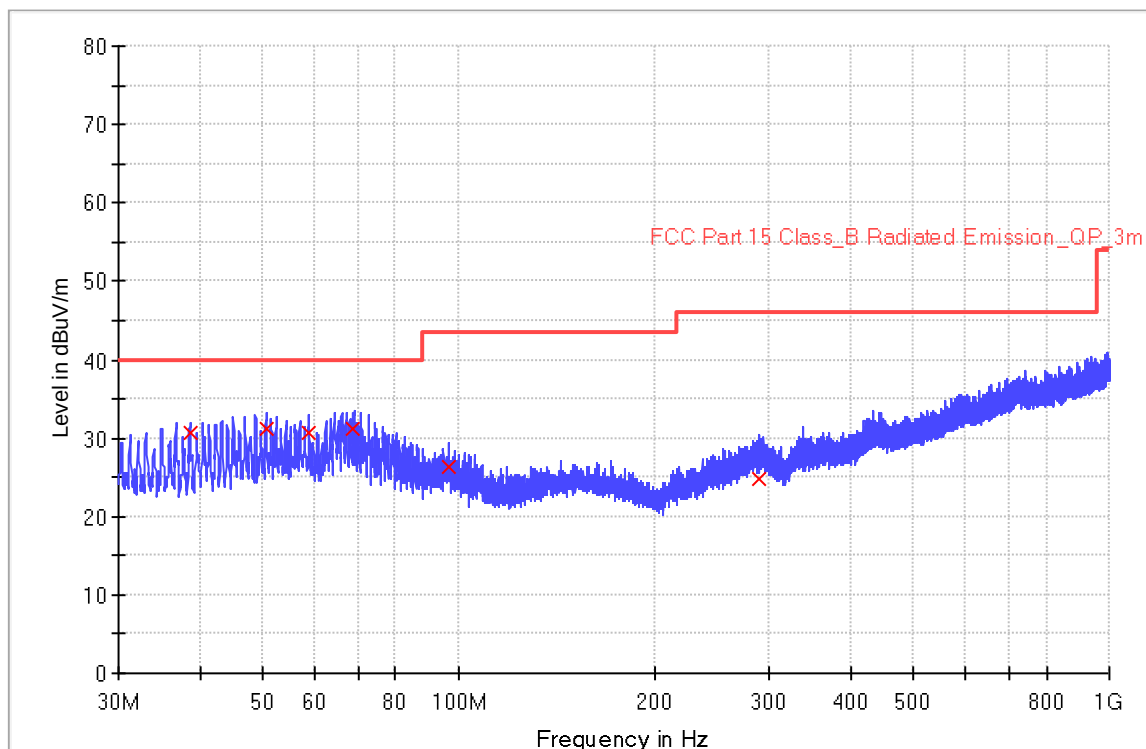
EUT Name:	Multi-function Detector
Model:	KC-109D
Client:	NDI TOOLS LLC
Op Cond:	Power on, DC 4.5V, T21.3, H50.7%, P103.0kPa
Operator:	Cheng Huali
Test Spec:	FCC 15.209(a)
Comment:	Vertical
Sample No:	SHA-721330-1

Sweep Setup: RE_VULB9168_pre_Cont_30-1000 [EMI radiated]

Hardware Setup:	RE_VULB9168
Receiver:	[ESR 3]
Level Unit:	dBuV/m

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamplifier
30 MHz - 1 GHz	48.5 kHz	PK+	120 kHz	0.2 s	20 dB

RE_VULB9168_pre_Cont_30-1000



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
38.640000	30.6	1000.0	120.000	153.0	V	205.0	19.8	9.4	40.0
50.560000	31.2	1000.0	120.000	214.0	V	114.0	20.6	8.8	40.0
58.840000	30.7	1000.0	120.000	185.0	V	326.0	20.3	9.3	40.0
68.960000	31.3	1000.0	120.000	159.0	V	95.0	18.8	8.8	40.0
96.480000	26.3	1000.0	120.000	198.0	V	75.0	15.7	17.2	43.5
288.880000	24.8	1000.0	120.000	103.0	V	103.0	21.3	21.2	46.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz), therefore no data appear in the report.

9.2 20 dB Bandwidth Measurement

Test Method

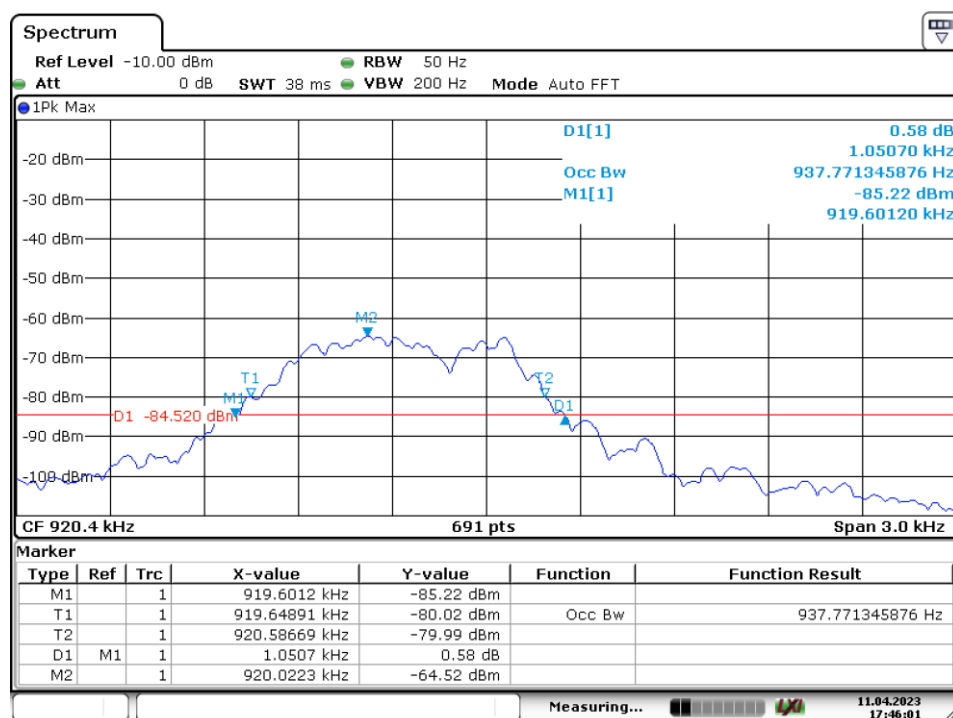
1. The RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Use the following test receiver settings:
Span = approximately 5 times the 20dB bandwidth, centered on a hopping channel
RBW =1% to 5% of the 20dB bandwidth of the emission being measured, VBW≥RBW,
Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth. Record the results.
5. Repeat above procedures until all frequencies measured were complete.

Limit

According to 15.215 (c), recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test Result

Channel	20dB Bandwidth (KHz)	Result
1	1.0507	Pass



Date: 11.APR.2023 17:46:01

10 Test Equipment List

List of Test Instruments

USED	Equipment Name	Model	Manufacturer	Equipment ID.	Calibration Date	Calibration Due
☒	EMI test receiver	ESR3	R&S	S1503109-YQ-EMC	2022.8.1	2023.7.31
☒	Trilog super broadband test antenna	SCHWARZBECK	VULB9168	S1808296-YQ-EMC	2021.9.23	2024.9.22
☐	Temperature Chamber	HTT-100AP	Shanghai HUCAN	S2201430b-YQ-EMC	2022.3.08	2023.3.07
☒	Loop antenna	HFH2-Z2	R&S	S1503013-YQ-EMC	2022.6.13	2023.6.12
☒	EMI test receiver	R & S	ESR3	S1503001-YQ-EMC	2022.8.1	2023.7.31
☐	2-Line V-network	R & S	ENV216	S1503103-YQ-EMC	2022.8.1	2023.7.31

11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

Items	Extended Uncertainty
Radiated Disturbance	30MHz to 1GHz, $\pm 5.03\text{dB}$ (Horizontal) $\pm 5.11\text{dB}$ (Vertical) 1GHz to 18GHz, $\pm 5.15\text{dB}$ (Horizontal) $\pm 5.12\text{dB}$ (Vertical)