Test Report

Verified code: 178872

Report No.: E20240611910801-5

Customer:	Hefei Invispower Co., Ltd
Address:	2A, Yousi Tiancheng Industrial Park, No. 1800, Dabieshan Road, High-tech Zone, Heifei China
Sample Name:	NKR3 ECU
Sample Model:	NKR3-O-SX-21470
Receive Sample Date:	Jun.18,2024
Test Date:	Jul.08,2024 ~ Jul.08,2024
Reference Document:	47 CFR Part 15 Subpart C Intentional Radiators
Test Result:	Pass

Prepared by: Huang Lifang

Reviewed by: Wu Haoting

Approved by: Xiao Liang

GRG METROLOGY & TEST GROUP CO., LTD.

Issued Date: 2024-08-06

GRG METROLOGY & TEST GROUP CO., LTD.
Address: No.163,Pingyun Road, West of Huangpu Avenue, Guangzhou, Guangdong, China
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Statement

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5. This testing report is only for scientific research, teaching, internal quality control, etc.

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REPORT ISSUED HISTORY

Report Version	Report No.	Description	Compile Date
1.0	E20240611910801-5	Original Issue	2024-07-09

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1. TEST RESULT SUMMARY

Technical Requirements			
47 CFR Part 15 Subpart C			
Item	**FCC Standard Chapter**	**Report Chapter**	**Result**
Antenna requirements	§15.203	Chapter 5	Complied
Radiated Spurious Emissions	§15.225(a),(b),(c),(d) §15.209	Chapter 7	Complied
20dB Bandwidth	§15.215	Chapter 8	Complied
Frequency Stability Tolerance	§15.225(e)	Chapter 9	Complied
AC Conducted Emission	§15.207	Chapter 6	N/A[1)]

Note:
[1)] Test is not applicable to this Equipment. This EUT is no AC mains power ports.

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2. GENERAL DESCRIPTION OF EUT

2.1 APPLICANT

Name:	Hefei Invispower Co., Ltd
Address:	2A, Yousi Tiancheng Industrial Park, No. 1800, Dabieshan Road, High-tech Zone, Heifei China

2.2 MANUFACTURER

Name:	Hefei Invispower Co., Ltd
Address:	2A, Yousi Tiancheng Industrial Park, No. 1800, Dabieshan Road, High-tech Zone, Heifei China

2.3 FACTORY

Name:	Jiangsu InvisPower Co., Ltd
Address:	No.100, Xinning Road,Chongchuan District, Nantong City, Jiangsu Province, P.R.China

2.4 BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

Equipment:	NKR3 ECU
Model No.:	NKR3-O-SX-21470
Adding Model:	/
Model Differences:	/
Trade Name:	INVISPOWER
FCC ID:	2BBHHYGKJ-CM1ENFC
Power supply:	DC 9-16V, 15A(Max)
Frequency Range:	13.56MHz
Modulation type:	ASK
Antenna Specification:	PCB Antenna
Temperature Range:	-35℃ ~ +85℃
Hardware Version:	V1.2
Software Version:	V4.3
Sample No:	E20240611910801-0002
Note:	1.The basic description of the EUT is provided by the applicant. This report is made Solel yon the basis of such data and/or information.We accept no responsibility for the authenticity and completeness of the above data and information and the validity of the results and/or conclusions.

2.5 TEST OPERATION MODE

Test Item	Mode No.	Description of the modes
Radiated Spurious Emission	1,2	Mode 1:Intermittent Transmitting (13.56MHz TX) Mode 2:Continuously Transmitting (13.56MHz TX)
20dB Bandwidth	1,2	Mode 1:Intermittent Transmitting (13.56MHz TX) Mode 2:Continuously Transmitting (13.56MHz TX)
Frequency Stability Tolerance	1,2	Mode 1:Intermittent Transmitting (13.56MHz TX) Mode 2:Continuously Transmitting (13.56MHz TX)

NOTE: 1.Mode 1 is the EUT inducted with card;Mode 2 is the EUT has independent emission.

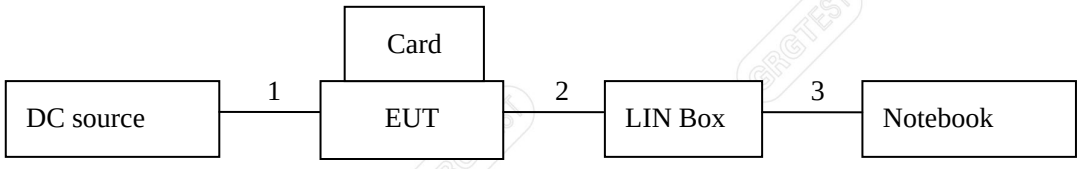
2.6 LOCAL SUPPORTIVE

Name of Equipment	Manufacturer	Model	Serial Number	Note
DC source	KEYSIGHT	E36131A	MY59001135	/
Card	/	/	/	/
LIN Box	/	/	/	/
Notebook	DELL	Latitude3490	2095LR2	/

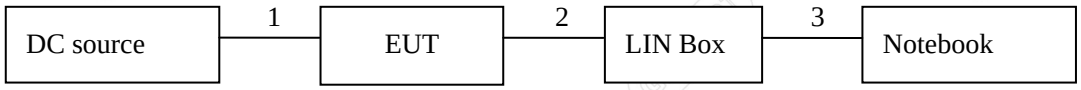
No.	Cable Type	Qty.	Shielded Type	Ferrite Core(Qty.)	Length
1	DC Cable	1	No	0	1.5m
2	DC Cable	1	No	0	1.0m
3	USB Cable	1	No	0	1.0m

2.7 CONFIGURATION OF SYSTEM UNDER TEST

Mode 1:



Mode 2:



2.8 TEST SOFTWARE

Software version	Test level
Uart2any V1.53	/

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3. LABORATORY AND ACCREDITATIONS

3.1 LABORATORY

The tests & measurements refer to this report were performed by Shenzhen EMC Laboratory of Guangzhou GRG Metrology & Test Co., Ltd.

Add	:	Address: No.1301 Guanguang Road Xinlan Community, Guanlan Street, Longhua District Shenzhen, 518110, People's Republic of China
P.C.	:	518110
Tel	:	0755-61180008
Fax	:	0755-61180008

3.2 ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to GB/T 27025(ISO/IEC 17025:2017)

USA	A2LA(Certificate #2861.01)

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	ISED (Company Number: 24897，CAB identifier:CN0069)
USA	FCC (Registration Number: 759402，Designation Number:CN1198)

Copies of granted accreditation certificates are available for downloading from our web site, http://www.grgtest.com

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3.3 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT

Measurement	Uncertainty
RF frequency	6.0×10^{-6}
Humidity	6.0 %
Temperature	2.0℃

Measurement		Frequency	Uncertainty
Radiated Emission	X	9kHz～30MHz	4.4dB
	Y	9kHz～30MHz	4.4dB
	Z	9kHz～30MHz	4.4dB
	Horizontal	30MHz～200MHz	4.6dB
	Vertical	30MHz～200MHz	4.7dB
	Horizontal	200MHz～1000MHz	4.8dB
	Vertical	200MHz～1000MHz	4.7dB

This uncertainty represents an expanded uncertainty factor of *k*=2.
This uncertainty represents an expanded uncertainty expressed at approximately the 95%.

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4. LIST OF USED TEST EQUIPMENT AT GRGT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Radiated Spurious Emission				
Test Receiver	R&S	ESR26	101758	2024-09-22
Loop Antenna	schwarzbeck	FMZB 1513-60	1513-60-56	2024-07-15
Bi-log Antenna	Schwarzbeck	VULB 9160	VULB9160-3401	2024-12-04
Preamplifier	SHIRONG ELECTRONIC	DLNA-30M1G-G41	20200928002	2024-10-24
Test Software	Tonscend	JS32-RE/2.5.1.5		
Test Software	Tonscend	JS36-RSE/5.0.0.1		
20dB Bandwidth &Frequency StabilityTolerance				
Spectrum Analyzer	R&S	FSV30	1321.3008K30-104381-rH	2024-10-13
Programmable constant temperature and humidity test chamber	FC	FPHC-23AW-40	FD202306015	2024-09-10
DC power source	KEYSIGHT	E36131A	MY59001135	2024-09-22

Note: The calibration cycle of the above instruments is 12 months.

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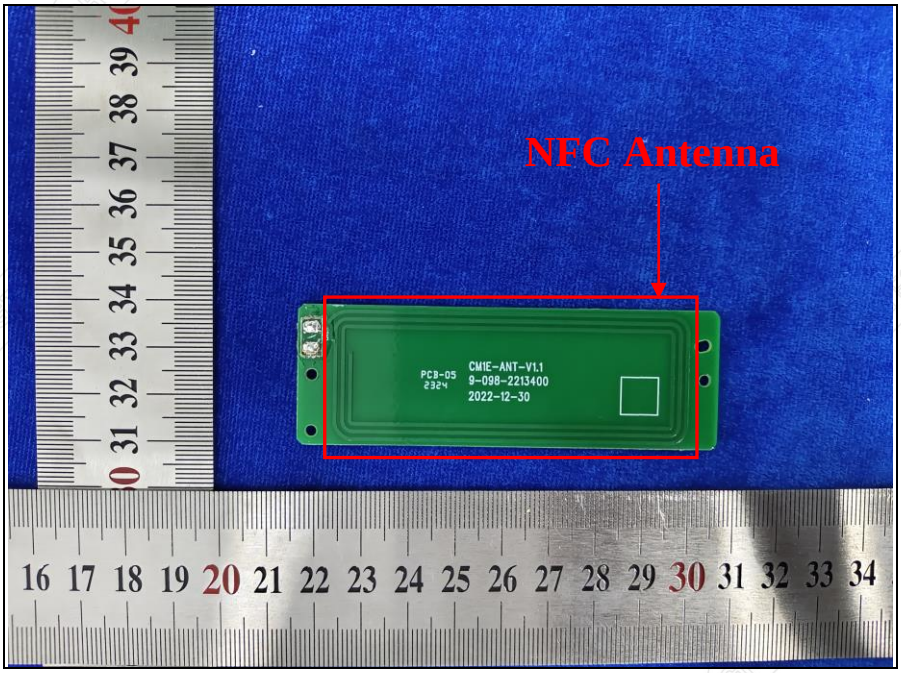
5. ANTENNA REQUIREMENTS

5.1 LIMIT

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. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

5.2 TEST RESULT

The antenna is PCB antenna, so compliance with antenna requirements.



6. CONDUCTED EMISSION MEASUREMENT

6.1 LIMITS

Frequency range	Limits (dBμV)	
	Quasi-peak	Average
150kHz～0.5MHz	66～56	56～46
0.5MHz～5MHz	56	46
5MHz～30MHz	60	50

NOTE: (1) The lower limit shall apply at the transition frequencies.

(2) The limit decreases in line with the logarithm of the frequency in the range of 150 kHz to 0.5MHz.

6.2 TEST PROCEDURES

Procedure of Preliminary Test

Test procedures follow ANSI C63.10:2020.

For measurement of the disturbance voltage the equipment under test (EUT) is connected to the power supply mains and any other extended network via one or more artificial network(s). An EUT, whether intended to be grounded or not, and which is to be used on a table is configured as follows:

– Either the bottom or the rear of the EUT shall be at a controlled distance of 40 cm from a reference ground plane. This ground plane is normally the wall or floor of a shielded room. It may also be a grounded metal plane of at least 2 m by 2 m. This is physically accomplished as follows:

1) place the EUT on a table of non-conducting material which is at least 80 cm high. Place the EUT so that it is 40 cm from the wall of the shielded room, or

2) place the EUT on a table of non-conducting material which is 40 cm high so that the bottom of the EUT is 40 cm above the ground plane;

– All other conductive surfaces of the EUT shall be at least 80 cm from the reference ground plane;

– The EUT are placed on the floor that one side of the housings is 40 cm from the vertical reference ground plane and other metallic parts;

– Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 cm to 40 cm long, hanging approximately in the middle between the ground plane and the table.

– I/O cables that are connected to a peripheral shall be bundled in the centre. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1 m.

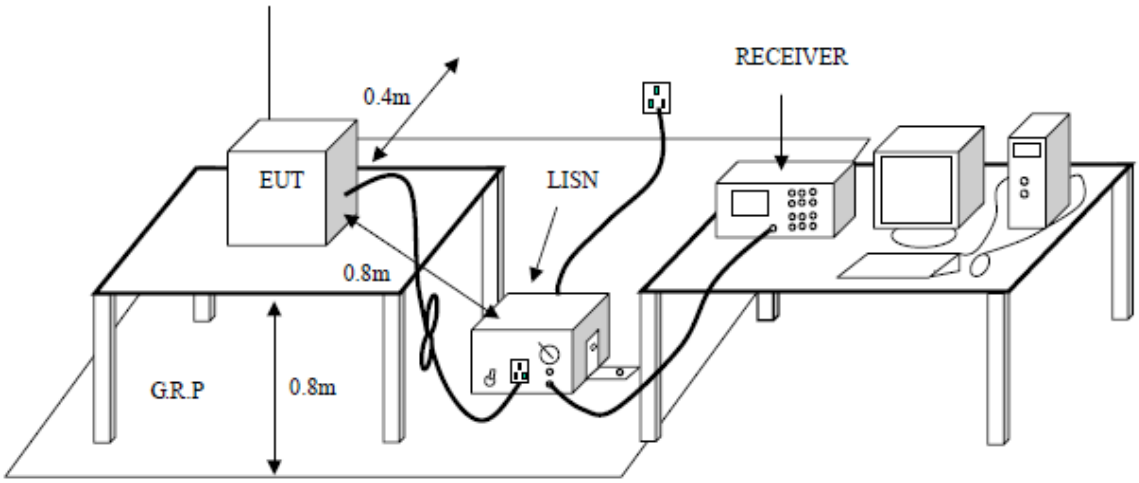
– Use serial board or connecting line to make EUT and notebook to communicate, according to the actual need to make EUT send constant frequency signal continuously.

The test mode(s) described in Item 2.6 were scanned during the preliminary test. After the preliminary scan, we found the test mode described in Item 2.6 producing the highest emission level.The EUT configuration and cable configuration of the above highest emission levels were recorded for reference of the final test.

Procedure of Final Test

EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test. A scan was taken on both power lines, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. The test data of the worst-case condition(s) was recorded.

6.3 TEST SETUP



6.4 DATA SAMPLE

Frequency (MHz)	QuasiPeak Reading (dBuV)	Average Reading (dBuV)	Correction Factor (dB)	QuasiPeak Result (dBuV)	Average Result (dBuV)	QuasiPeak Limit (dBuV)	Average Limit (dBuV)	QuasiPeak Margin (dB)	Average Margin (dB)	Remark (Pass/Fail)
X.XXXX	32.69	25.65	11.52	44.21	37.17	65.78	55.79	-21.57	-18.62	Pass

Factor = Insertion loss of LISN + Cable Loss
Result = Quasi-peak Reading/ Average Reading + Factor
Limit = Limit stated in standard
Margin = Result (dBuV) – Limit (dBuV)

6.5 TEST RESULTS

Note: Test is not applicable to this Equipment. This EUT is no AC mains power ports.

7. RADIATED SPURIOUS EMISSIONS

7.1 LIMITS

IN BAND SPURIOUS EMISSIONS

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

OUT BAND RADIATED SPURIOUS EMISSIONS

Frequency (MHz)	Quasi-peak(μV/m)	Measurement distance(m)	Quasi-peak(dBμV/m)@distance 3m
0.009-0.490	2400/F(kHz)	300	128.5~93.8
0.490-1.705	24000/F(kHz)	30	73.8~63
1.705-30.0	30	30	69.5
30 ~ 88	100	3	40
88~216	150	3	43.5
216 ~ 960	200	3	46
Above 960	500	3	54

NOTE: (1) The lower limit shall apply at the transition frequencies.

7.2 TEST PROCEDURES

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Pre measurement:

--- The turntable rotates from 0 °to 360 °.

--- The antenna height is 1.0 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the pre measurement the software maximizes by rotating the turntable position (0 °to 360 °) and by rotating the elevation axes (0 °to 360 °).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QP detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Pre measurement:

--- The turntable rotates from 0 °to 360 °.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 4 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of pre measurement the software maximize the peaks by changing turntable position (0 °to 360 °) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement with marked maximum final measurements and the limit will be stored.

Remark： Pre-scan all modes, mode 1 is the worst mode. Therefore, only the data of mode 1 is recorded in the report.

7.3 MEASURING INSTRUMENTS SETTING

Frequency (MHz)	Instrument	Detector	Resolution Bandwidth	Video Bandwidth
0.009 to 30	Receiver	QP	200Hz: 0.009 to 0.15MHz 10kHz: 0.15 to 30MHz	3*RBW
30 to 1000	Receiver	QP	120kHz	3*RBW

7.4 TEST SETUP

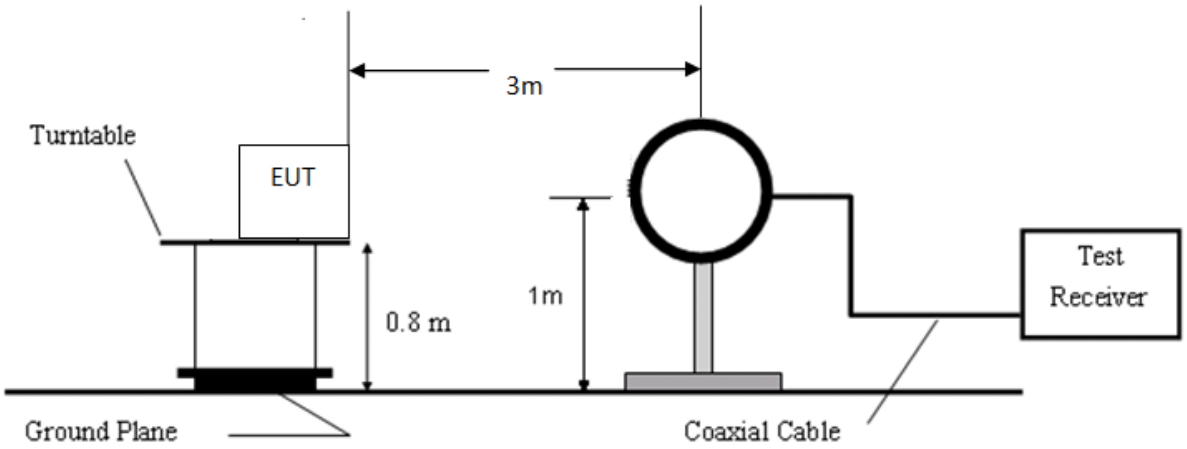


Figure 1. 9kHz to 30MHz radiated emissions test configuration

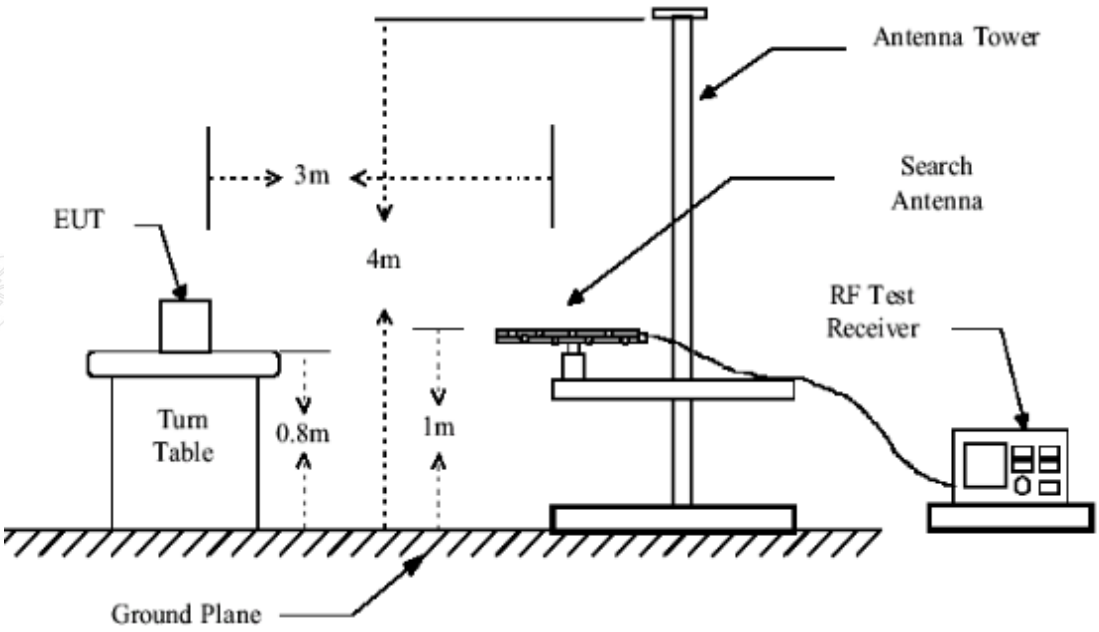


Figure 2. 30MHz to 1GHz radiated emissions test configuration

7.5 DATA SAMPLE

Below 30MHz

Frequency [MHz]	Level [dBµV/m at 3m]	Factor [dB]	Conversion factor (dB)	Level [dBµV/m at 10m]	Limit [dBµV/m at 10m]	Margin [dB]	Height [cm]	Detector	Angle [°]	Polarity
xxx	-13.67	-32.05	31.3	17.67	27	9.33	100	QP	336	X

Frequency (MHz) = Emission frequency in MHz
Level (dBuV/m at 3m) = Reading (dBuV/m) + Factor (dB)
Level (dBuV/m at 10m) = Level (dBuV/m at 3m) - Conversion factor (dB)
Conversion factor (dB) = Annex H.2 of ETSI EN 300 330 V2.1.1
Margin (dB) = Limit(dBuV/m) - Level (dBuV/m at 10m)
QP = Quasi-peak Reading

30MHz - 1GHz

Suspected Data List										
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Height [cm]	Angle [°]	Polarity
xxxx	xxxx	64.21	34.78	-29.43	40.00	5.22	PK	100	13	Horizontal

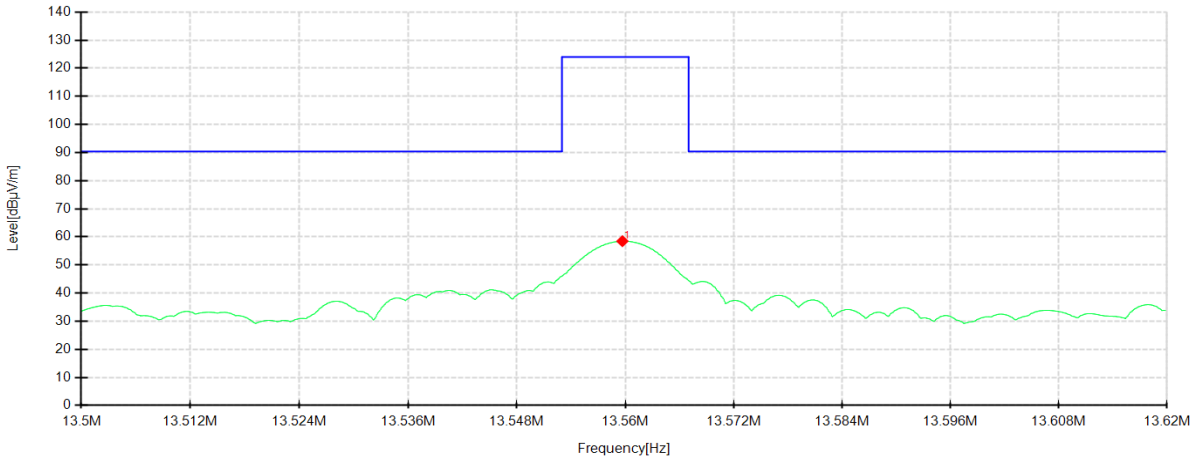
Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Reading [dBµV/m]	Level [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
xxxx	xxxx	-29.43	62.25	32.82	40.00	7.18	100	13	Horizontal

Frequency (MHz) = Emission frequency in MHz
Reading (dBuV/m) = Uncorrected Analyzer / Receiver reading
Level (dBuV/m) = Reading (dBuV/m) + Factor (dB)
Limit (dBuV/m) = Limit stated in standard
Margin (dB) = Level (dBuV/m) – Limit(dBuV/m)
PK = Peak Reading
QP = Quasi-peak Reading

7.6 TEST RESULTS

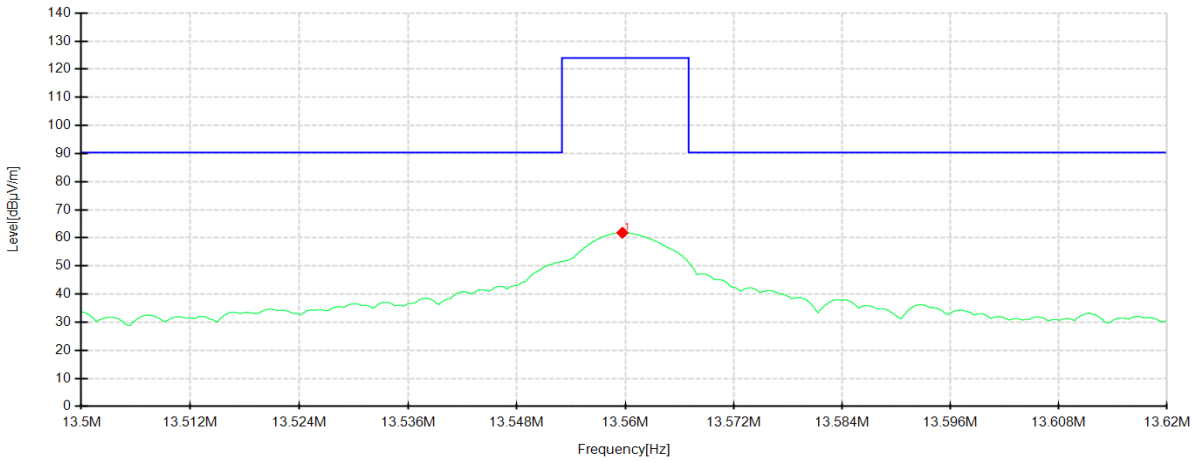
7.6.1 IN BAND RADIATED SPURIOUS EMISSIONS

Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 1	Voltage:	DC 12V
Environment:	23.7℃/54%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-07-08	/	/



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	13.559	37.65	58.47	20.82	124.00	65.53	100	165	X

Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 1	Voltage:	DC 12V
Environment:	23.7℃/54%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-07-08	/	/



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	13.559	41.01	61.83	20.82	124.00	62.17	100	270	Y

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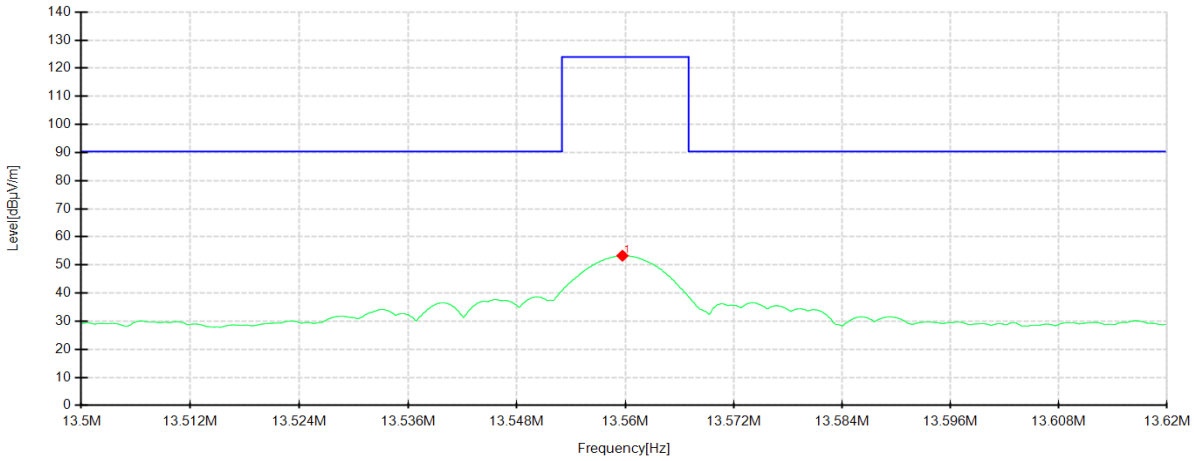
Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 1	Voltage:	DC 12V
Environment:	23.7℃/54%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-07-08	/	/



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	13.559	32.46	53.28	20.82	124.00	70.72	100	193	Z

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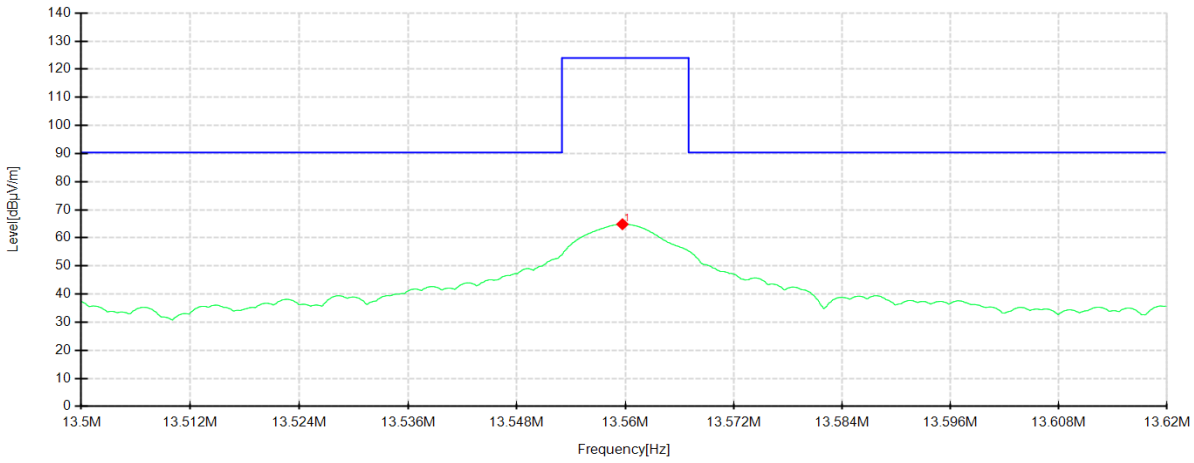
Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 2	Voltage:	DC 12V
Environment:	23.7℃/54%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-07-08	/	/



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	13.559	44.04	64.86	20.82	124.00	59.14	100	358	X

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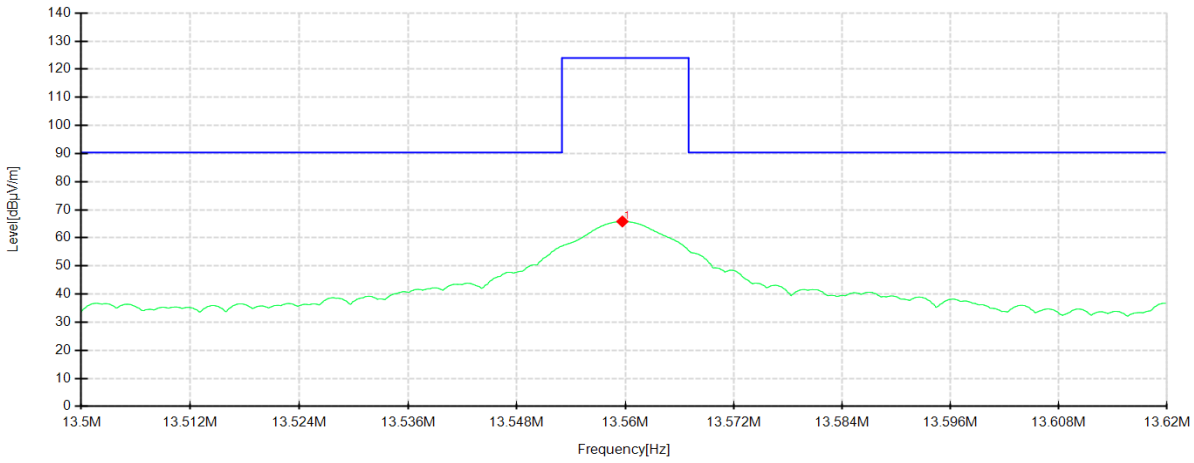
Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 2	Voltage:	DC 12V
Environment:	23.7℃/54%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-07-08	/	/



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	13.559	45.01	65.83	20.82	124.00	58.17	100	260	Y

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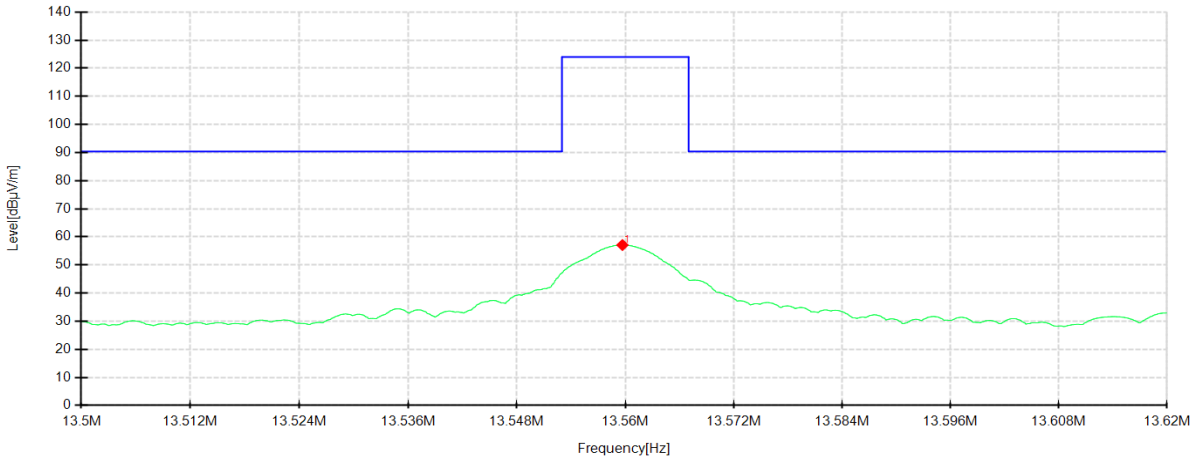
Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 2	Voltage:	DC 12V
Environment:	23.7℃/54%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-07-08	/	/



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	13.559	36.28	57.10	20.82	124.00	66.90	100	187	Z

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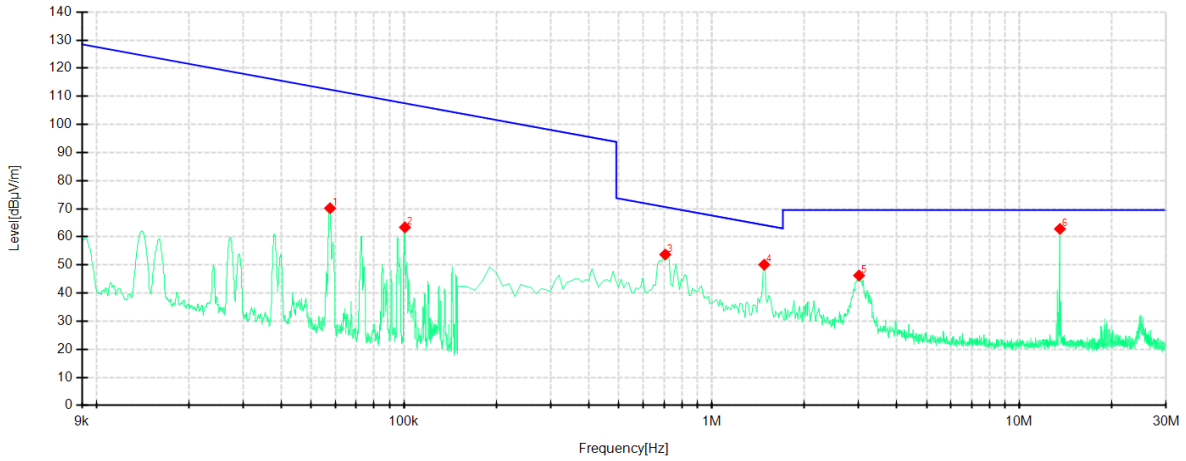
7.6.2 OUT BAND RADIATED SPURIOUS EMISSIONS

9kHz-30MHz

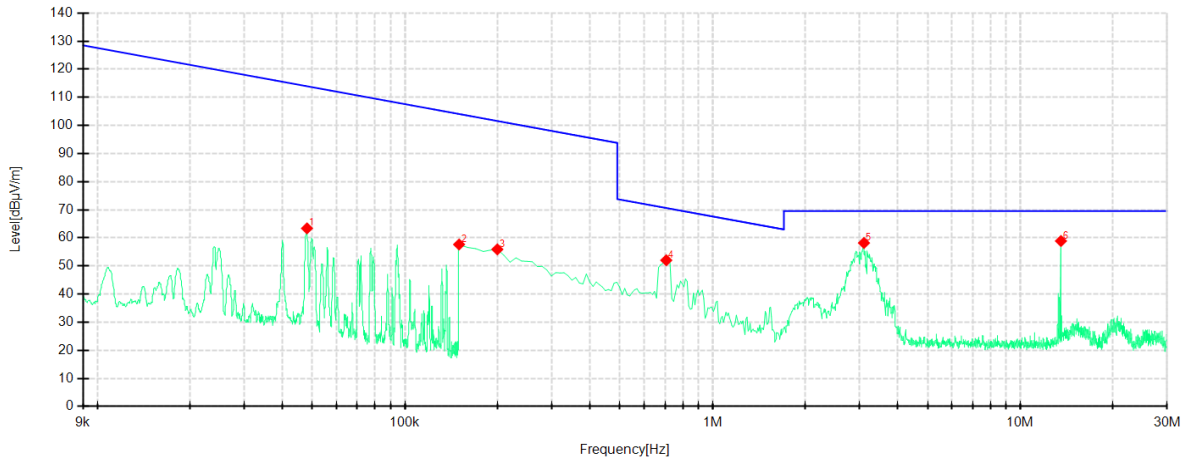
Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 1	Voltage:	DC 12V
Environment:	25.1℃/52%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-06-28	/	/



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	0.0576	50.43	70.18	19.75	112.39	42.21	100	174	X
2	0.1008	43.69	63.39	19.70	107.53	44.14	100	210	X
3	0.7072	33.89	53.72	19.83	70.62	16.90	100	32	X
4	1.4833	30.36	50.11	19.75	64.21	14.10	100	102	X
5	3.0156	26.26	46.26	20.00	69.54	23.28	100	56	X
6	13.562	42.00	62.82	20.82	69.54	6.72	100	305	X

Note:NO.6 is the fundamental frequency point.

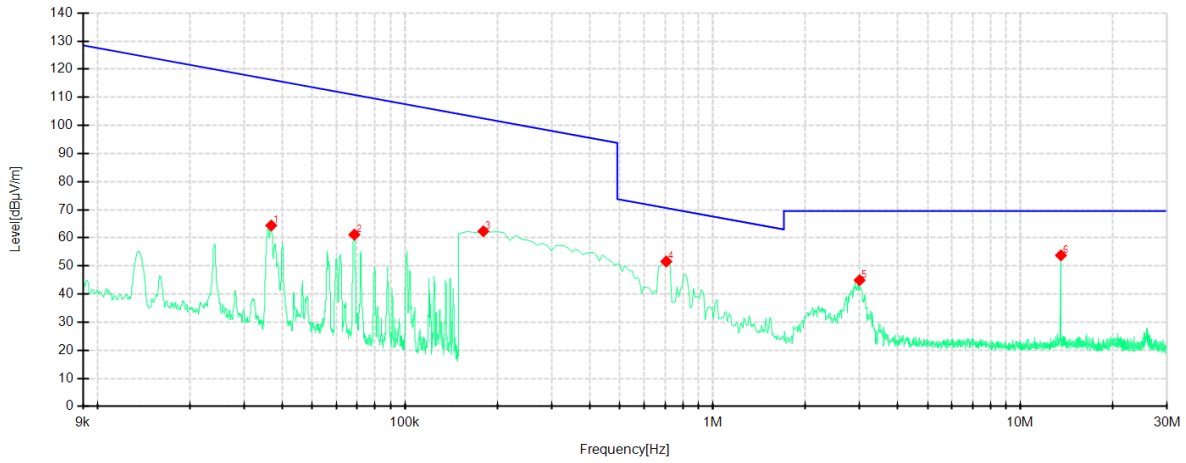
Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 1	Voltage:	DC 12V
Environment:	25.1℃/52%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-06-28	/	/



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	0.0481	43.69	63.38	19.69	113.96	50.58	100	256	Y
2	0.1500	38.04	57.65	19.61	104.08	46.43	100	258	Y
3	0.1998	36.37	55.91	19.54	101.59	45.68	100	258	Y
4	0.7072	32.20	52.03	19.83	70.62	18.59	100	352	Y
5	3.1052	38.15	58.18	20.03	69.54	11.36	100	258	Y
6	13.562	38.06	58.88	20.82	69.54	10.66	100	100	Y

Note:NO.6 is the fundamental frequency point.

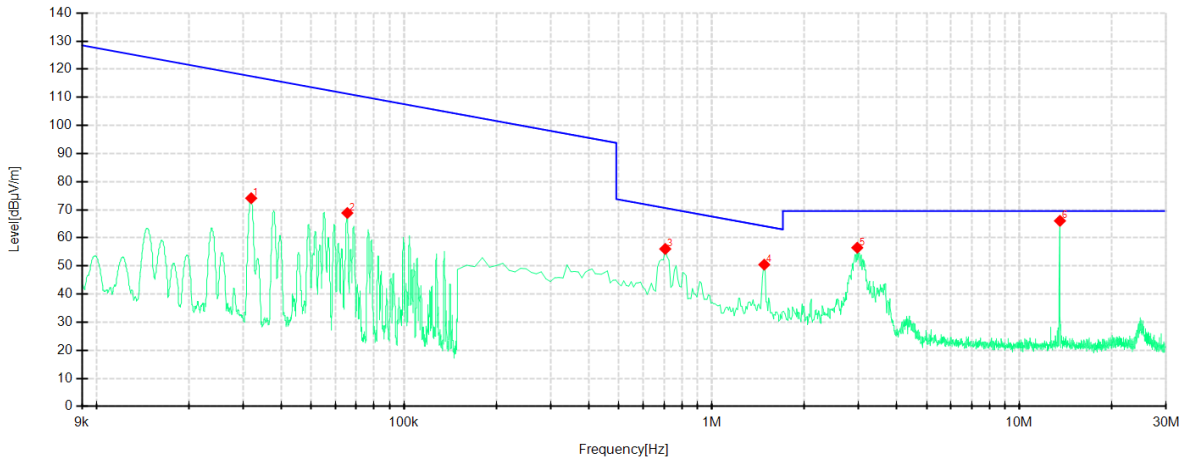
Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 1	Voltage:	DC 12V
Environment:	25.1℃/52%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-06-28	/	/



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	0.0368	44.77	64.40	19.63	116.28	51.88	100	175	Z
2	0.0685	41.33	61.15	19.82	110.88	49.73	100	233	Z
3	0.1799	42.76	62.33	19.57	102.50	40.17	100	162	Z
4	0.7072	31.76	51.59	19.83	70.62	19.03	100	20	Z
5	3.0057	24.95	44.94	19.99	69.54	24.60	100	126	Z
6	13.562	32.96	53.78	20.82	69.54	15.76	100	359	Z

Note:NO.6 is the fundamental frequency point.

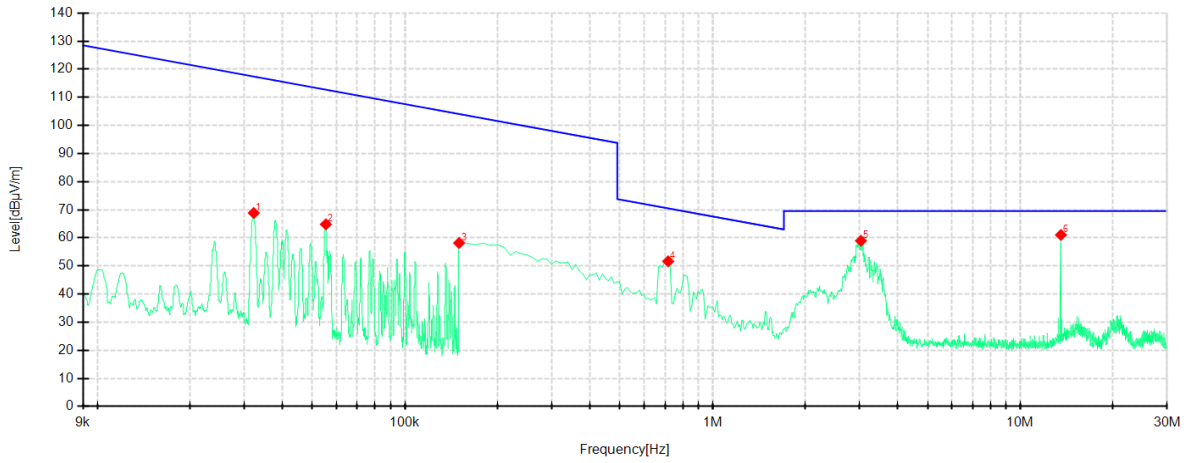
Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 2	Voltage:	DC 12V
Environment:	25.1℃/52%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-06-28	/	/



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	0.0319	54.50	74.11	19.61	117.52	43.41	100	174	X
2	0.0655	49.05	68.85	19.80	111.27	42.42	100	0	X
3	0.7072	36.22	56.05	19.83	70.62	14.57	100	115	X
4	1.4833	30.73	50.48	19.75	64.21	13.73	100	91	X
5	2.9758	36.51	56.49	19.98	69.54	13.05	100	102	X
6	13.562	45.24	66.06	20.82	69.54	3.48	100	151	X

Note:NO.6 is the fundamental frequency point.

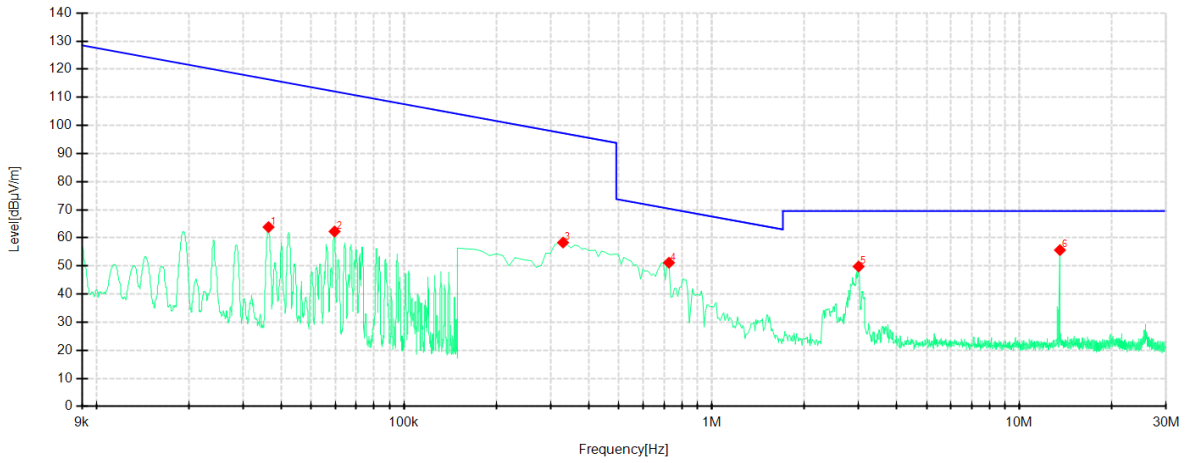
Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 2	Voltage:	DC 12V
Environment:	25.1℃/52%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-06-28	/	/



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	0.0323	49.24	68.85	19.61	117.42	48.57	100	118	Y
2	0.0553	45.07	64.81	19.74	112.73	47.92	100	257	Y
3	0.1500	38.57	58.18	19.61	104.08	45.90	100	55	Y
4	0.7172	31.85	51.65	19.80	70.50	18.85	100	231	Y
5	3.0355	38.95	58.95	20.00	69.54	10.59	100	20	Y
6	13.562	40.22	61.04	20.82	69.54	8.50	100	113	Y

Note:NO.6 is the fundamental frequency point.

Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 2	Voltage:	DC 12V
Environment:	25.1℃/52%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-06-28	/	/



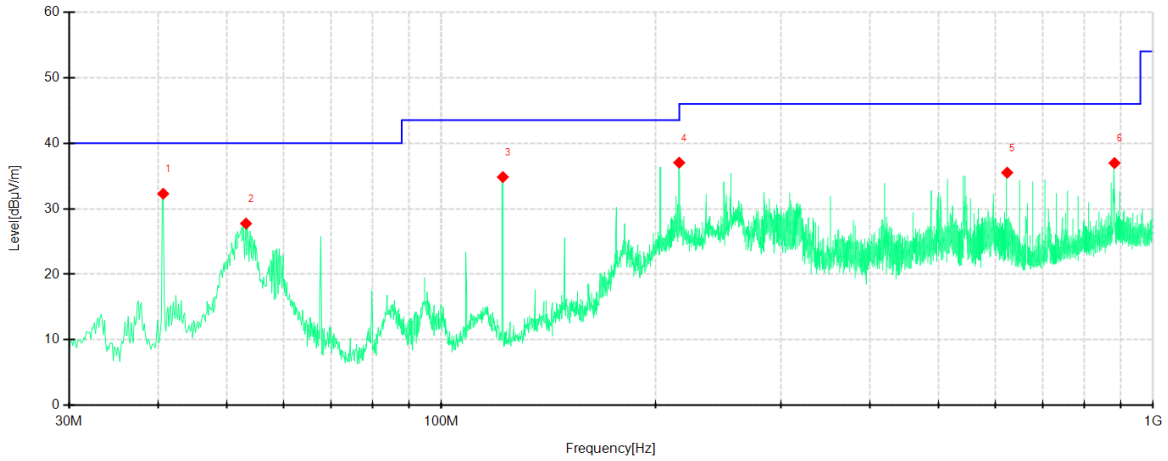
Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	0.0363	44.20	63.83	19.63	116.39	52.56	100	188	Z
2	0.0595	42.52	62.28	19.76	112.10	49.82	100	327	Z
3	0.3291	38.88	58.33	19.45	97.26	38.93	100	360	Z
4	0.7271	31.39	51.17	19.78	70.38	19.21	100	171	Z
5	3.0057	29.83	49.82	19.99	69.54	19.72	100	359	Z
6	13.562	34.84	55.66	20.82	69.54	13.88	100	20	Z

Note:NO.6 is the fundamental frequency point.

30MHz-1GHz

Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 1	Voltage:	DC 12V
Environment:	25.6℃/58%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-06-27	/	/

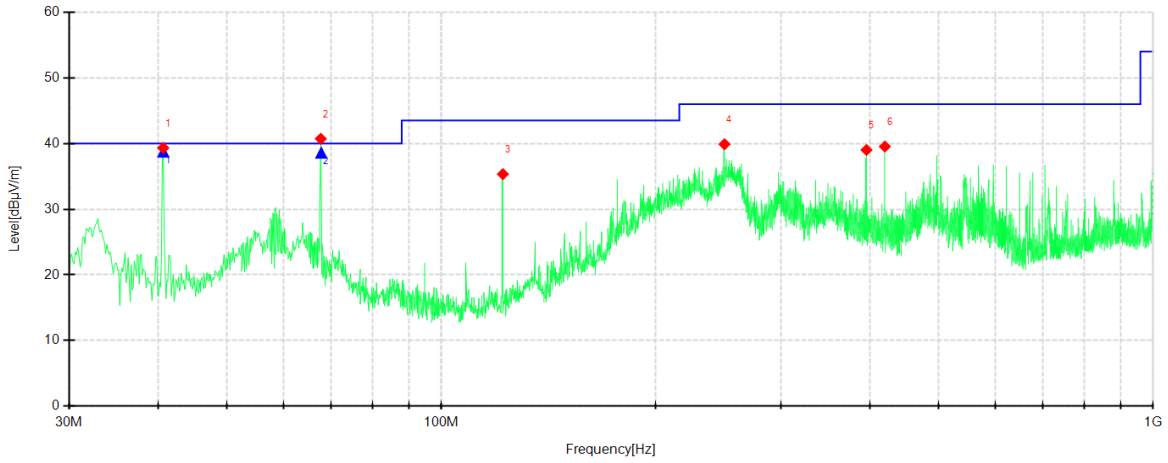
Polarity: Horizontal



Suspected Data List										
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Height [cm]	Angle [°]	Polarity
1	40.6713	61.56	32.29	-29.27	40.00	7.71	PK	200	93	Horizontal
2	53.1616	56.80	27.75	-29.05	40.00	12.25	PK	200	263	Horizontal
3	122.0403	64.81	34.84	-29.97	43.50	8.66	PK	200	224	Horizontal
4	215.8995	68.20	37.03	-31.17	43.50	6.47	PK	200	14	Horizontal
5	623.8355	54.37	35.51	-18.86	46.00	10.49	PK	200	198	Horizontal
6	882.9791	52.69	36.97	-15.72	46.00	9.03	PK	100	241	Horizontal

Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 1	Voltage:	DC 12V
Environment:	25.6℃/58%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-06-27	/	/

Polarity: Vertical

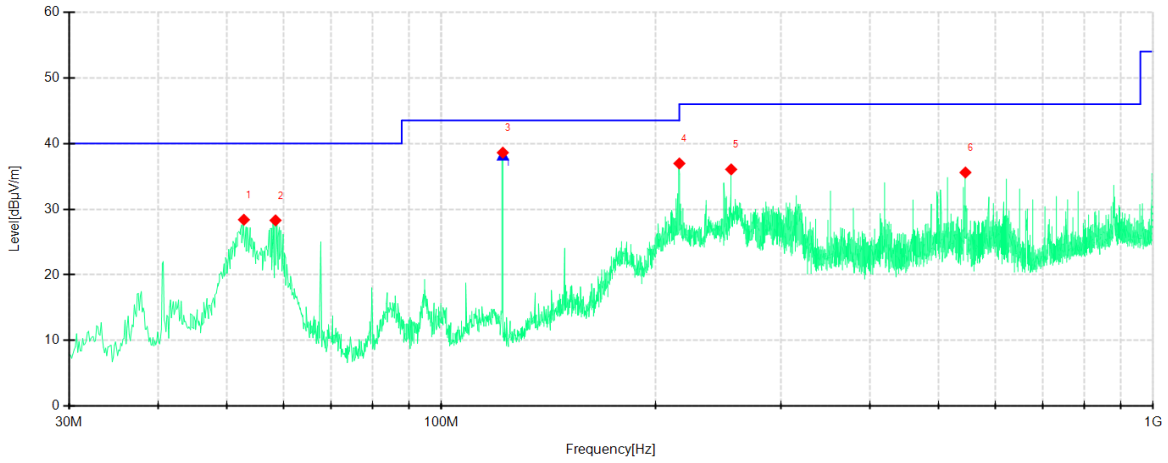


Suspected Data List										
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Height [cm]	Angle [°]	Polarity
1	40.6713	61.56	32.29	-29.27	40.00	7.71	PK	200	93	Vertical
2	53.1616	56.80	27.75	-29.05	40.00	12.25	PK	200	263	Vertical
3	122.0403	64.81	34.84	-29.97	43.50	8.66	PK	200	224	Vertical
4	215.8995	68.20	37.03	-31.17	43.50	6.47	PK	200	14	Vertical
5	623.8355	54.37	35.51	-18.86	46.00	10.49	PK	200	198	Vertical
6	882.9791	52.69	36.97	-15.72	46.00	9.03	PK	100	241	Vertical

Final Data List										
NO.	Freq. [MHz]	Factor [dB]	QP Reading [dBµV/m]	Level [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	40.6766	-29.27	68.01	38.74	40.00	1.26	100	104.1	Vertical	PASS
2	67.8046	-30.69	69.26	38.57	40.00	1.43	120	274.7	Vertical	PASS

Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 2	Voltage:	DC 12V
Environment:	25.6℃/58%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-06-27	/	/

Polarity: Horizontal

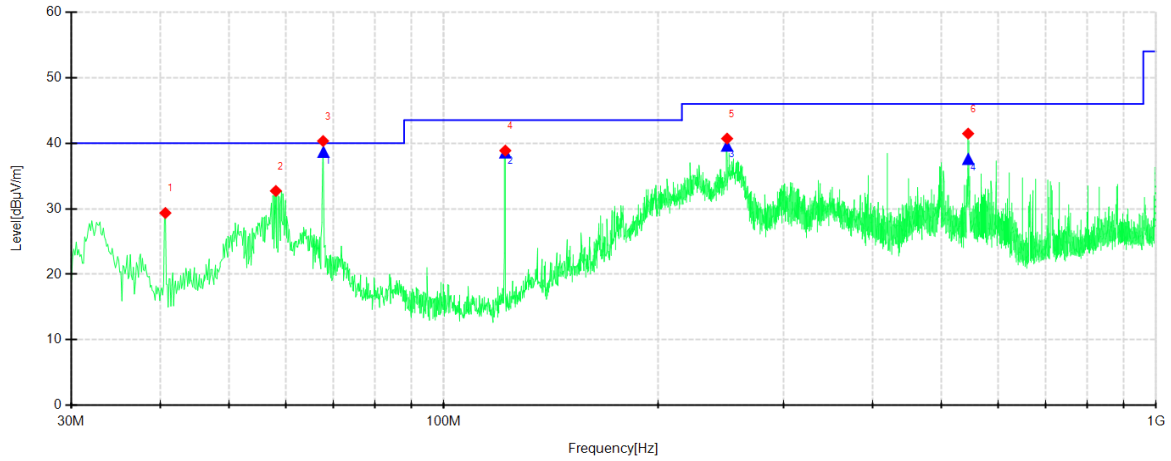


Suspected Data List										
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Height [cm]	Angle [°]	Polarity
1	52.7979	57.43	28.40	-29.03	40.00	11.60	PK	200	235	Horizontal
2	58.4973	57.71	28.30	-29.41	40.00	11.70	PK	100	293	Horizontal
3	122.0403	68.58	38.61	-29.97	43.50	4.89	PK	200	209	Horizontal
4	216.0208	68.12	36.96	-31.16	46.00	9.04	PK	200	157	Horizontal
5	255.4319	65.38	36.06	-29.32	46.00	9.94	PK	100	320	Horizontal
6	545.0131	56.13	35.59	-20.54	46.00	10.41	PK	200	341	Horizontal

Final Data List										
NO.	Freq. [MHz]	Factor [dB]	QP Reading [dBµV/m]	Level [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	122.0456	-29.97	68.26	38.29	43.50	5.21	190	223.5	Horizontal	PASS

Project Information			
Application No.:	E20240611910801	EUT:	NKR3 ECU
Model:	NKR3-O-SX-21470	SN:	E20240611910801-0002
Mode:	Mode 2	Voltage:	DC 12V
Environment:	25.6℃/58%RH/101.0kPa	Engineer:	Chen Xiaocong
Test date:	2024-06-27	/	/

Polarity: Vertical



Suspected Data List										
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Height [cm]	Angle [°]	Polarity
1	40.6713	58.62	29.35	-29.27	40.00	10.65	PK	100	261	Vertical
2	58.1335	62.11	32.72	-29.39	40.00	7.28	PK	200	217	Vertical
3	67.7135	71.02	40.33	-30.69	40.00	-0.33	PK	100	338	Vertical
4	122.0403	68.84	38.87	-29.97	43.50	4.63	PK	100	338	Vertical
5	249.9750	70.12	40.70	-29.42	46.00	5.30	PK	100	248	Vertical
6	544.8919	62.00	41.46	-20.54	46.00	4.54	PK	100	248	Vertical

Final Data List										
NO.	Freq. [MHz]	Factor [dB]	QP Reading [dBµV/m]	Level [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity	Verdict
1	67.8007	-30.69	69.34	38.65	40.00	1.35	101	237.3	Vertical	PASS
2	122.0403	-29.97	68.52	38.55	43.50	4.95	100	268.3	Vertical	PASS
3	249.9750	-29.42	69.00	39.58	46.00	6.42	100	268.2	Vertical	PASS
4	545.0653	-20.54	58.10	37.56	46.00	8.44	100	32.7	Vertical	PASS

8. 20dB BANDWIDTH

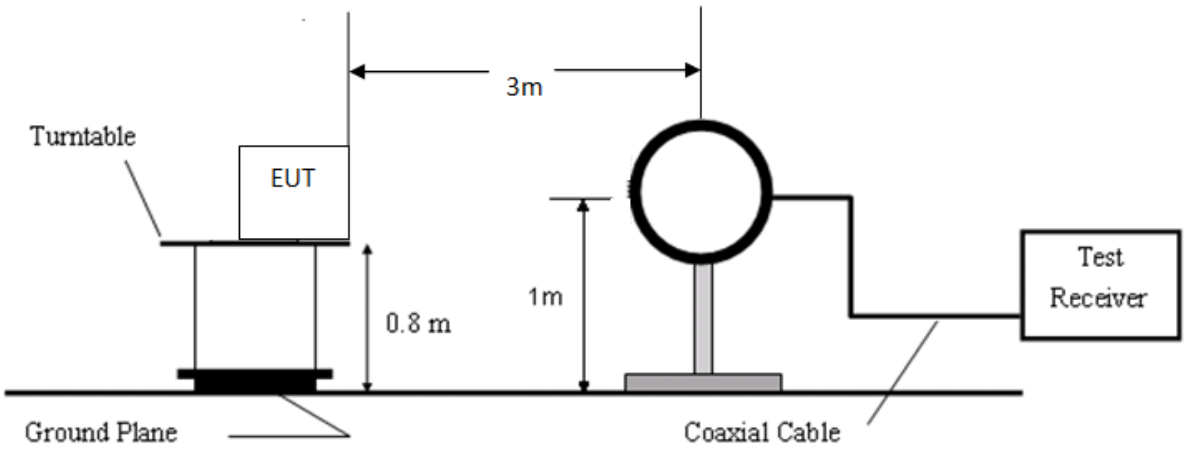
8.1 LIMITS

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §15.217 through §15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is 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.

8.2 TEST PROCEDURES

1) The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
2) If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.
3) If the EUT is a floor standing device, it is placed on the ground.
4) Auxiliary equipment and cables were positioned to simulate normal operation conditions.
5) The measurement distance is 3 meter.
6) The EUT was set into operation.
7) Adjust the test instrument for the following setting
   RBW: 1% to 5% of the Necessary bandwidth
   VBW: at least 3 times of the RBW
   Detector: Peak
   Sweep time: Auto
   Trace Mode: Max hold
8) Allow trace to fully stabilize

8.3 TEST SETUP



8.4 TEST RESULTS

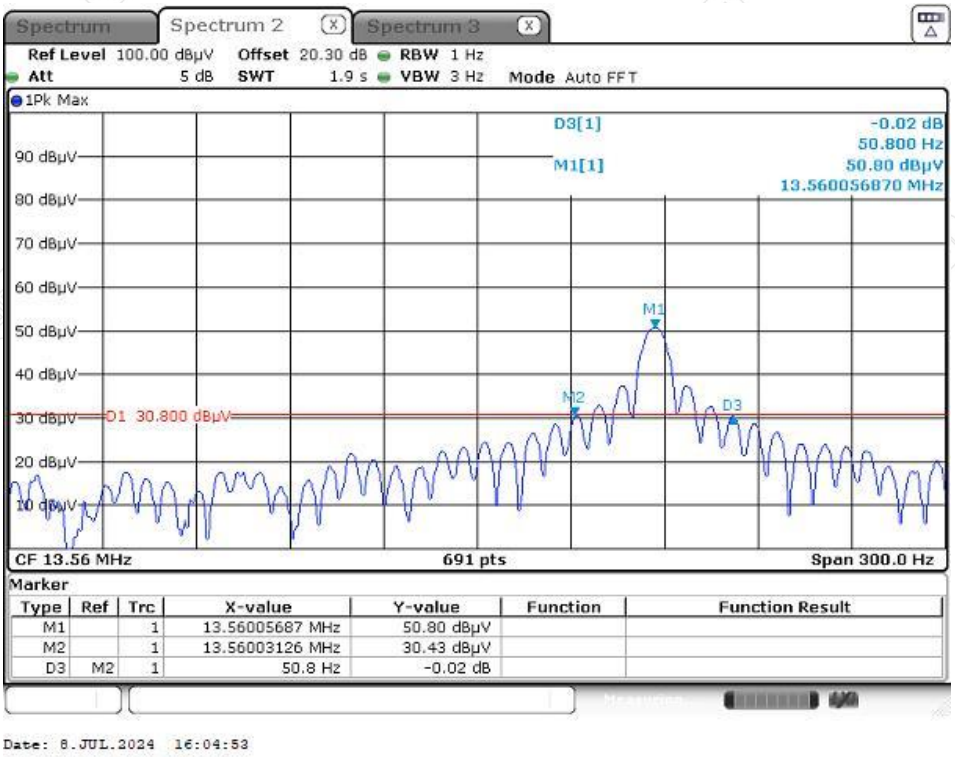
Test environment: Normal condition: 23.7℃/54%RH/101.0kPa

Engineer: Qin Tingting

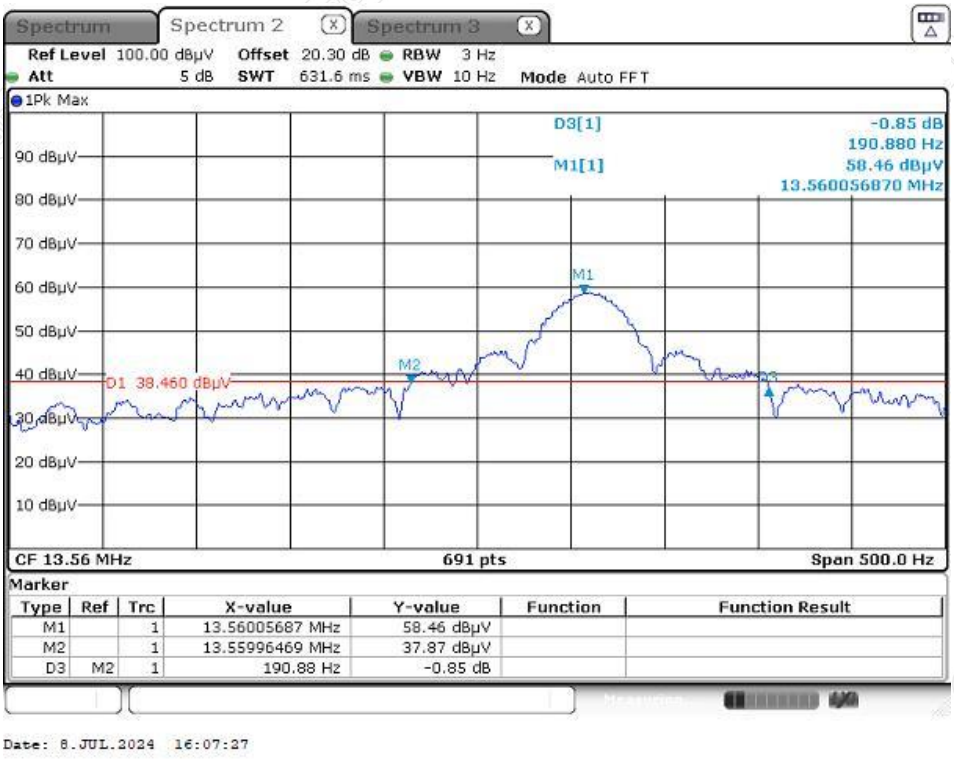
Test date: 2024-07-08

Note: This report records the worst polarity Y results of the loop antenna.

Test mode	Frequency (MHz)	20dB Bandwidth (Hz)	Test Result
Mode 1	13.56	50.8	Complied
Mode 2	13.56	190.88	Complied



Mode 1



Mode 2

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9. FREQUENCY TOLERANCE (TEMPERATURE VARIATION AND VOLTAGE VARIATION)

9.1 LIMITS

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage , and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

9.2 TEST PROCEDURES

Frequency tolerance (Temperature variation)

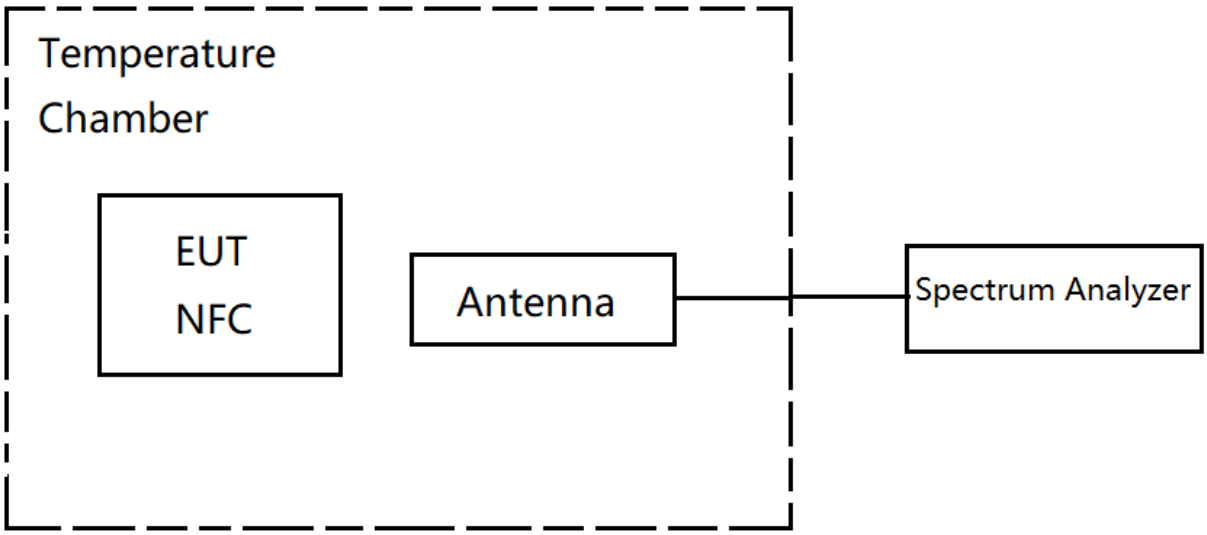
1) The EUT and test equipment were setup as shown on the following page.
2) Set the temperature -20 degrees C.
3) Leave the EUT for 1 hour after it become the temperature that was setup.
4) Setup the EUT to transmitting.
5) Measure the transmitting frequency (startup, 2min, 5min and 10min).
6) Set the temperature -20 degrees C to +50 degrees C.
7) Repeat test procedure the step 4 to 6, and record the test data after the testing finished.

Frequency tolerance (Voltage variation)

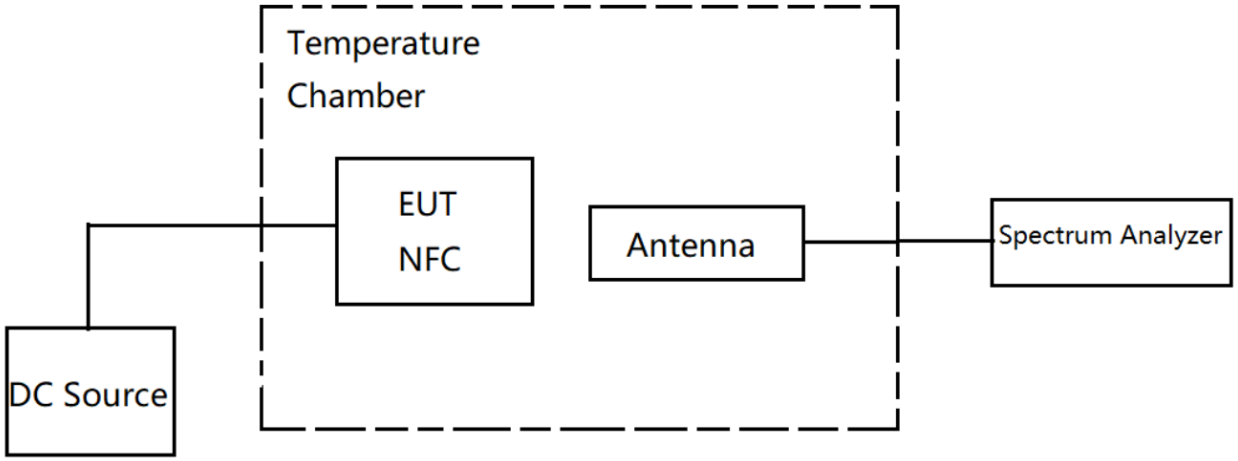
1) The EUT and test equipment (set the supply voltage 100%) were setup as shown on the following page.
2) Set the temperature 20 degrees C.
3) Leave the EUT for 1 hour after it become the temperature that was setup.
4) Setup the EUT to transmitting.
5) Measure the transmitting frequency.
6) Set the supply voltage 85% and 115%
7) Repeat test procedure the step 4 to 6, and record the test data after the testing finished.

9.3 TEST SETUP

Temperature Variation



Voltage variation



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9.4 TEST RESULTS

Test environment: Normal condition: 23.7℃/54%RH/101.0kPa

Engineer: Qin Tingting

Test date: 2024-07-08

Temperature Variation

startup

Transmitting Frequency (MHz)	Temperature (Degree C)	Voltage (V)	Frequency (MHz)	Deviation(%)	Limit(±) (%)
13.56	-20	12.0	13.56005687	0.000419	0.01
	-10	12.0	13.56005663	0.000418	0.01
	0	12.0	13.56005602	0.000413	0.01
	10	12.0	13.56005659	0.000417	0.01
	20	12.0	13.56005656	0.000417	0.01
	30	12.0	13.56005636	0.000416	0.01
	40	12.0	13.56005629	0.000415	0.01
	50	12.0	13.56005661	0.000417	0.01

2min

Transmitting Frequency (MHz)	Temperature (Degree C)	Voltage (V)	Frequency (MHz)	Deviation(%)	Limit(±) (%)
13.56	-20	12.0	13.56005681	0.000419	0.01
	-10	12.0	13.56005686	0.000419	0.01
	0	12.0	13.56005675	0.000419	0.01
	10	12.0	13.56005677	0.000419	0.01
	20	12.0	13.56005687	0.000419	0.01
	30	12.0	13.56005685	0.000419	0.01
	40	12.0	13.56005687	0.000419	0.01
	50	12.0	13.56005685	0.000419	0.01

5min

Transmitting Frequency (MHz)	Temperature (Degree C)	Voltage (V)	Frequency (MHz)	Deviation(%)	Limit(±) (%)
13.56	-20	12.0	13.56005659	0.000417	0.01
	-10	12.0	13.56005646	0.000416	0.01
	0	12.0	13.56005673	0.000418	0.01
	10	12.0	13.56005675	0.000419	0.01
	20	12.0	13.56005692	0.000420	0.01
	30	12.0	13.56005625	0.000415	0.01
	40	12.0	13.56005659	0.000417	0.01
	50	12.0	13.56005662	0.000418	0.01

10min

Transmitting Frequency (MHz)	Temperature (Degree C)	Voltage (V)	Frequency (MHz)	Deviation(%)	Limit(±) (%)
13.56	-20	12.0	13.56005687	0.000419	0.01
	-10	12.0	13.56005688	0.000419	0.01
	0	12.0	13.56005691	0.000420	0.01
	10	12.0	13.56005675	0.000419	0.01
	20	12.0	13.56005667	0.000418	0.01
	30	12.0	13.56005659	0.000417	0.01
	40	12.0	13.56005663	0.000418	0.01
	50	12.0	13.56005675	0.000419	0.01

Frequency tolerance (Voltage variation)

Transmitting Frequency (MHz)	Temperature (Degree C)	Voltage (V)	Frequency (MHz)	Deviation(%)	Limit(±) (%)
13.56	20	10.20	13.56005669	0.000418	0.01
	20	12.00	13.56005688	0.000419	0.01
	20	13.80	13.56005679	0.000419	0.01

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APPENDIX A. PHOTOGRAPH OF THE TEST CONNECTION DIAGRAM

Please refer to the attached document E20240611910801-7-Test Photo

APPENDIX B. PHOTOGRAPH OF THE EUT

Please refer to the attached document E20240611910801-8-EUT Photo.

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