Nanjing PowerCore Technology Co., Ltd.

RF TEST REPORT

Report Type:
FCC Part 15.225 RF report

Model:
NKR-AC006

REPORT NUMBER:
221001931SHA-001

ISSUE DATE:
March 10, 2023

DOCUMENT CONTROL NUMBER:
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TEST REPORT

Report no.: 221001931SHA-001

Applicant:	Nanjing PowerCore Technology Co., Ltd. 4th Floor, Jiangsu Science and Technology Finance Building, Yuhuatai District, Nanjing, Jiangsu, China
Manufacturer:	Nanjing PowerCore Technology Co., Ltd. 4th Floor, Jiangsu Science and Technology Finance Building, Yuhuatai District, Nanjing, Jiangsu, China
Factory:	Nanjing PowerCore Technology Co., Ltd. 4th Floor, Jiangsu Science and Technology Finance Building, Yuhuatai District, Nanjing, Jiangsu, China
FCC ID:	2A98K-AC006

SUMMARY:

The equipment complies with the requirements according to the following standard(s) or Specification:
47CFR Part 15 (2020): Radio Frequency Devices (Subpart C) **ANSI C63.10 (2013):** American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

PREPARED BY:	**REVIEWED BY:**
	
Project Engineer Sky Yang	Reviewer Eric Li

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Revision History

Report No.	Version	Description	Issued Date
221001931SHA-001	Rev. 01	Initial issue of report	March 10, 2023

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Measurement result summary

TEST ITEM	FCC REFERENCE	RESULT
Fundamental emission	15.225(a) (b) (c)	Pass
Spurious emission	15.225(d)	Pass
Frequency stability	15.225(e)	Pass
Conducted emissions	15.207	Pass
99% and 20dB Bandwidth	15.215(c)	Pass
Antenna requirement	15.203	Pass

Notes: 1: NA =Not Applicable

2: Determination of the test conclusion is based on IEC Guide 115 in consideration of measurement uncertainty.

TEST REPORT

1 GENERAL INFORMATION

1.1 Description of Equipment Under Test (EUT)

Product name:	AC Charger
Type/Model:	NKR-AC006
Description of EUT:	The EUT is electric vehicle AC charger with RFID and WIFI function, the WIFI module FCC ID is 2AC7Z-ESPWROOM32UE. It has three types of rated power. All three types are electrically identical except the rated power. We choose the 11kW types to test as representative and list the results in this report.
Rating:	Input: 240VAC±10%, 50/60Hz Output: 240V±10%, 7kW/9kW/11kW
EUT type:	☒ Table top ☐ Floor standing
Software Version:	-
Hardware Version:	-
Serial numbers:	0221103-24-001
Sample received date:	February 3, 2023
Date of test:	February 6, 2023 ~ February 13, 2023

1.2 Technical Specification

Frequency Range:	13.56 MHz ~ 13.56 MHz
Modulation:	ASK
Antenna:	PCB antenna

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1.3 Description of Test Facility

Name:	Intertek Testing Services Shanghai
Address:	Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China
Telephone:	86 21 61278200
Telefax:	86 21 54262353

The test facility is recognized, certified, or accredited by these organizations:	CNAS Accreditation Lab Registration No. CNAS L0139
	FCC Accredited Lab Designation Number: CN0175
	IC Registration Lab CAB identifier.: CN0014
	VCCI Registration Lab Member No.: 3598 (Registration No.: R-14243, G-10845, C-14723, T-12252)
	A2LA Accreditation Lab Certificate Number: 3309.02

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15 (2020)
ANSI C63.10 (2013)

2.2 Mode of operation during the test

While testing, the internal modulation and continuously transmission was applied.

2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.4 Test peripherals list

Item No	Description	Band and Model	S/No

2.5 Test environment condition:

Test items	Temperature	Humidity
Radiated emission	26°C	53% RH
Power line conducted emission	27°C	53% RH

2.6 Instrument list

Conducted Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Test Receiver	R&S	ESCS 30	EC 2107	2023-07-18
☒	A.M.N.	R&S	ESH2-Z5	EC 3119	2023-11-09
☒	Shielded room	Zhongyu	-	EC 2838	2024-01-10
Radiated Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Test Receiver	R&S	ESIB 26	EC 3045	2023-07-18
☒	Bilog Antenna	TESEQ	CBL 6112B	EC 6411	2023-08-23
☒	Active loop antenna	Schwarzbeck	FMZB1519	EC 5345	2023-06-15
☒	Semi-anechoic chamber	Albatross project	-	EC 3048	2023-07-08
RF test					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Spectrum Analyzer	Keysight	N9030B	EC 6078	2023-06-04
☐	Power sensor	Agilent	U2021XA	EC 5338-1	2023-03-14
☐	Vector Signal Generator	Agilent	N5182B	EC 5175	2023-03-14
☐	Universal Radio Communication Tester	R&S	CMW500	EC5944	2024-01-19
☐	MXG Analog Signal Generator	Agilent	N5181A	EC 5338-2	2023-03-14
☐	Mobile Test System	Litepoint	Iqxel	EC 5176	2024-01-10
☒	Climate chamber	GWS	MT3065	EC 6021	2024-03-07
Additional instrument					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Thermo-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3783	2023-03-24
☒	Thermo-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3442	2024-01-02

2.7 Measurement uncertainty

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Frequency	Expanded Uncertainty (k=2)
Conducted emission at mains ports	9kHz ~ 150kHz	3.52 dB
	150kHz ~ 30MHz	3.19 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.06 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.02 dB
	6GHz ~ 18GHz	5.28 dB

3 Fundamental Emission

Test result: **Pass**

3.1 Limit

Frequencies (MHz)	Limit at 30m (dBuV/m)	Limit at 3m (dBuV/m)
13.110 – 13.410	40.50	80.50
13.410 – 13.553	50.50	90.50
13.553 – 13.567	84.00	124.00
13.567 – 13.710	50.50	90.50
13.710 – 14.010	40.50	80.50

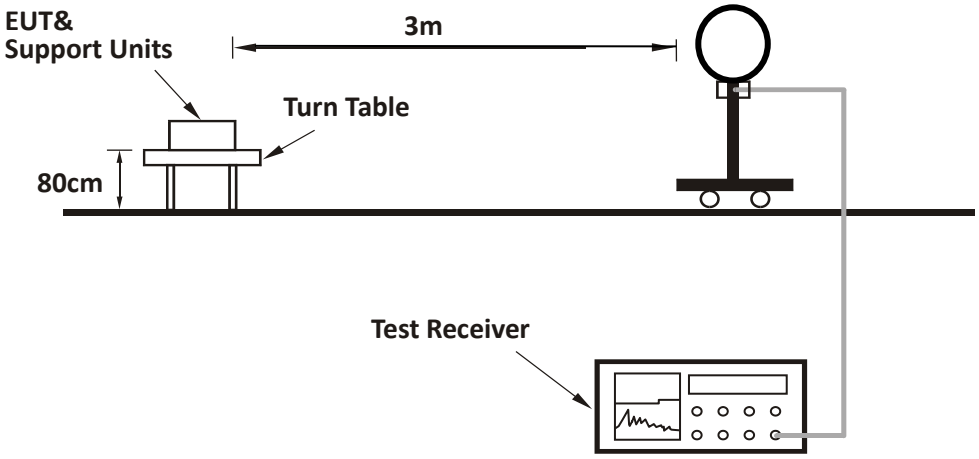
3.2 Measurement Procedure

a) The EUT was placed on a 0.8m plank above the ground at a 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c) Both X and Y axes of the antenna are set to make the measurement.
d) For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e) The test-receiver system was set to PK Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

3.3 Test Configuration



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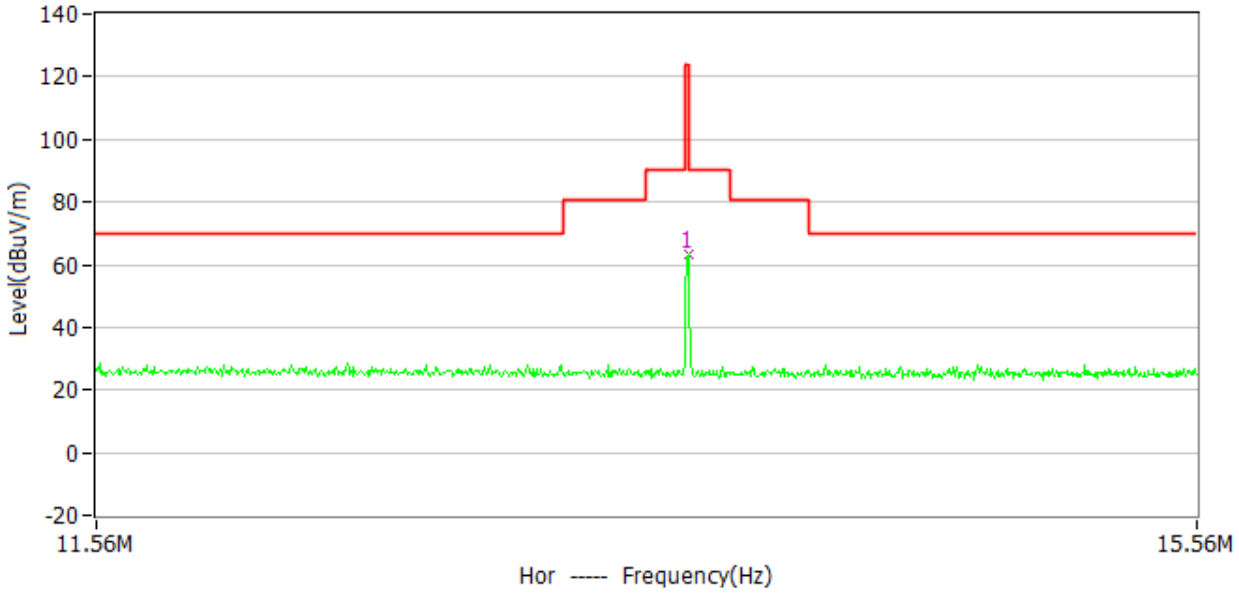
3.4 Test Results of Fundamental Emissions



Antenna Polarization	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin	Detector
X	13.56	63.1	20.4	124.00	60.9	PK
Y	13.56	56.4	20.4	124.00	67.6	PK

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = Limit - Corrected Reading

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV,
Limit = 40.00dBuV/m.
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;
Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m;
Margin = 40.00dBuV/m - 10.20dBuV/m = 29.80dB.

4 Spurious Emission

Test result: **Pass**

4.1 Limit

Frequencies (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

4.2 Measurement Procedure

For Radiated emission below 30MHz:

f) The EUT was placed on a 0.8m plank above the ground at a 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
g) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
h) Both X and Y axes of the antenna are set to make the measurement.
i) For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
j) The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz:

a) The EUT was placed on a 0.8m plank above the ground at a 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c) 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.

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d) 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.

e) The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f) The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

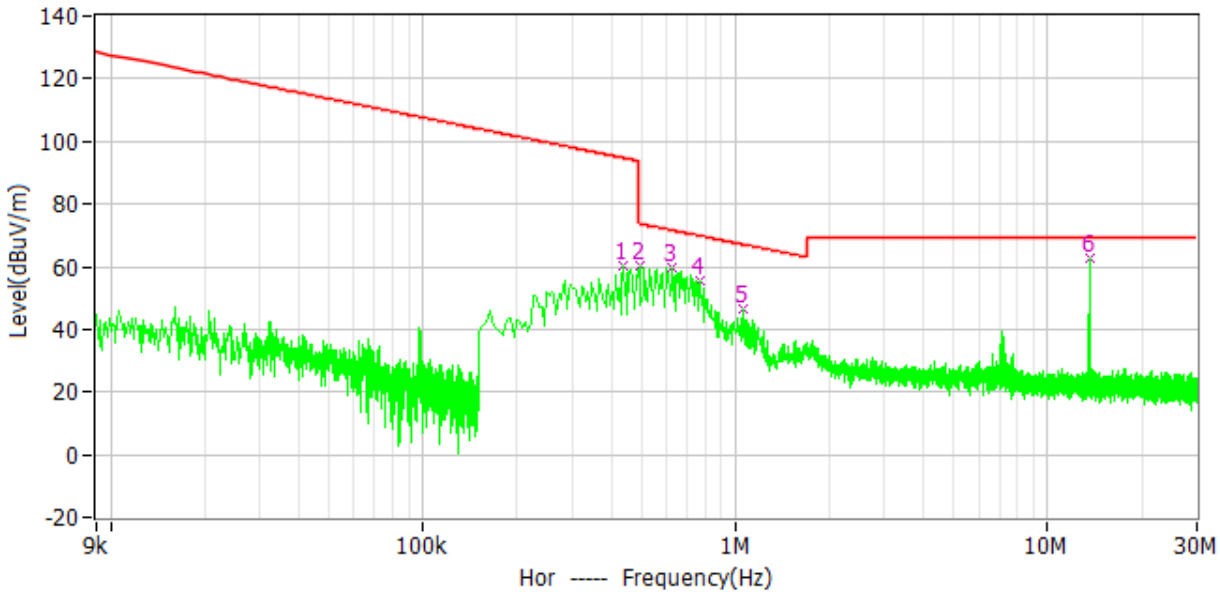
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. All modes of operation were evaluated and the worst-case emissions were reported

4.3 Test Results of Radiated Emissions

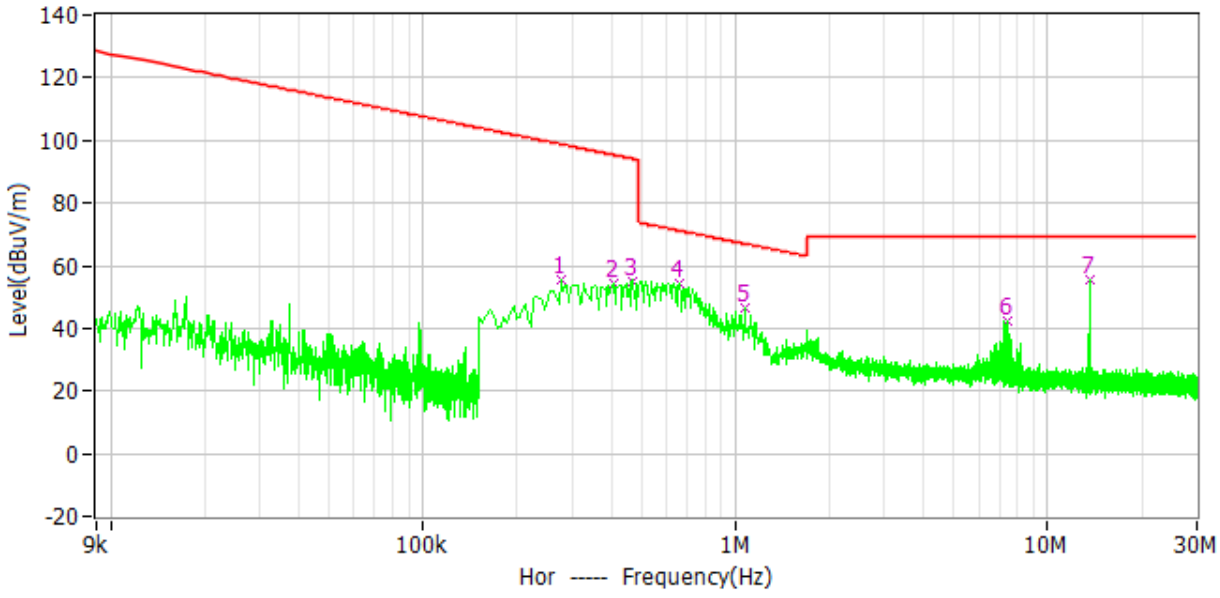
The EUT has been tested in all two orthogonal planes, it has the worst case when it is in horizontal position for both below 30MHz & above 30MHz.

Test Curve:

X



Y



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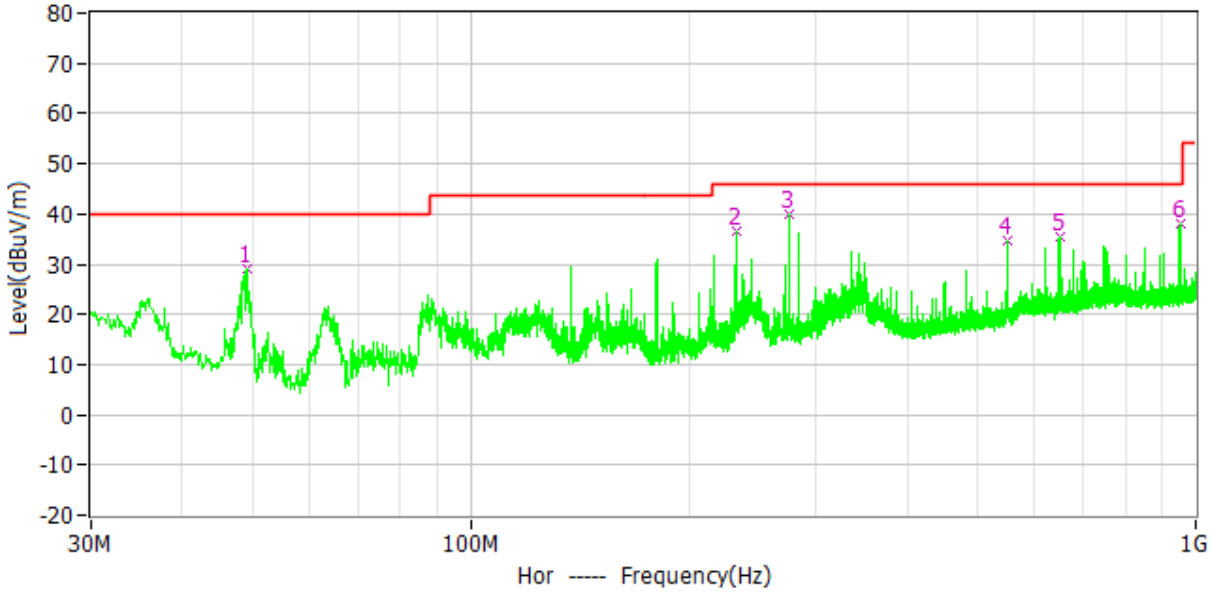
Test data below 30MHz:

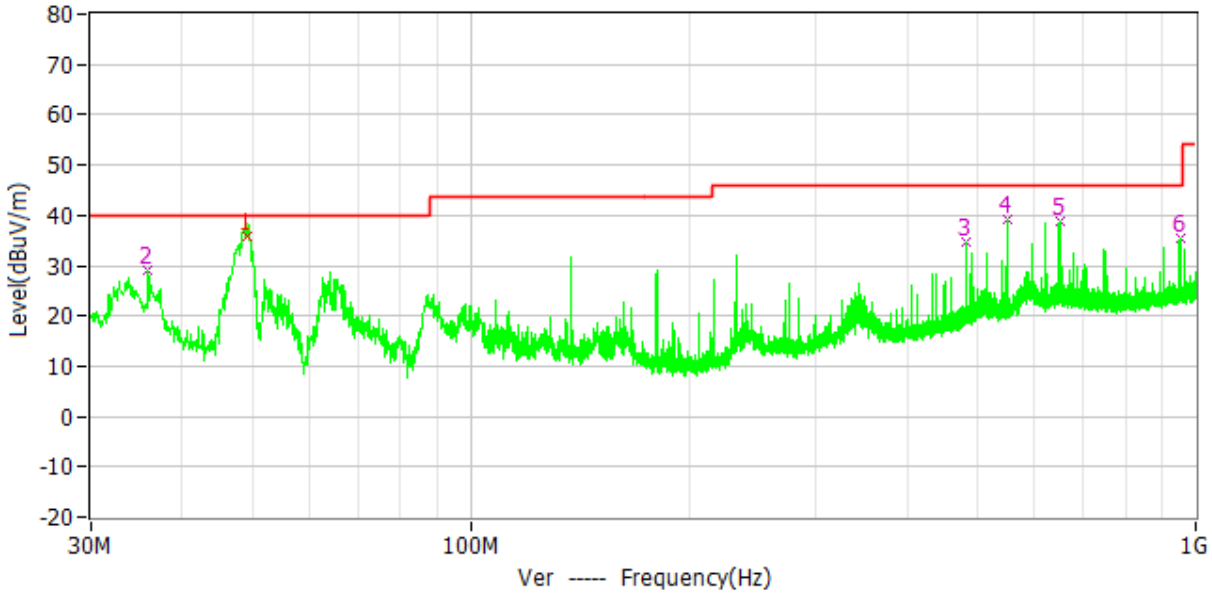
Frequency	Limit (dBuV/m)	Corrected Reading (dBuV/m)	Margin	Detector	Polarity
438.000kHz	94.8	60.5	-34.3	PK	X
492.000kHz	73.8	60.5	-13.3	PK	X
627.000kHz	71.7	59.5	-12.2	PK	X
766.500kHz	69.9	55.8	-14.1	PK	X
1.064MHz	67.1	46.3	-20.8	PK	X
276.000kHz	98.8	55.4	-43.4	PK	Y
406.500kHz	95.4	54.1	-41.3	PK	Y
469.500kHz	94.2	55.3	-38.9	PK	Y
658.500kHz	71.2	54.5	-16.7	PK	Y
1.073MHz	67.0	46.7	-20.3	PK	Y
7.445MHz	69.5	42.5	-27.0	PK	Y

TEST REPORT

H



V



Test data from 30MHz to 1000MHz:

Antenna Polarization	Frequency	Limit (dBuV/m)	Corrected Reading (dBuV/m)	Margin	Detector
H	49.206MHz	40.0	29.0	11.0	PK
H	232.245MHz	46.0	36.7	9.3	PK
H	275.216MHz	46.0	40.1	5.9	PK
H	550.502MHz	46.0	34.8	11.2	PK
H	651.673MHz	46.0	35.5	10.5	PK
H	952.470MHz	46.0	38.0	8.0	PK
V	49.126MHz	40.0	35.9	4.1	QP
V	35.917MHz	40.0	29.2	10.8	PK
V	481.729MHz	46.0	34.7	11.3	PK
V	550.502MHz	46.0	39.2	6.8	PK
V	651.673MHz	46.0	38.9	7.1	PK
V	952.470MHz	46.0	35.4	10.6	PK

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = Limit - Corrected Reading
4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV,
Limit = 40.00dBuV/m.
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;
Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m;
Margin = 40.00dBuV/m - 10.20dBuV/m = 29.80dB.

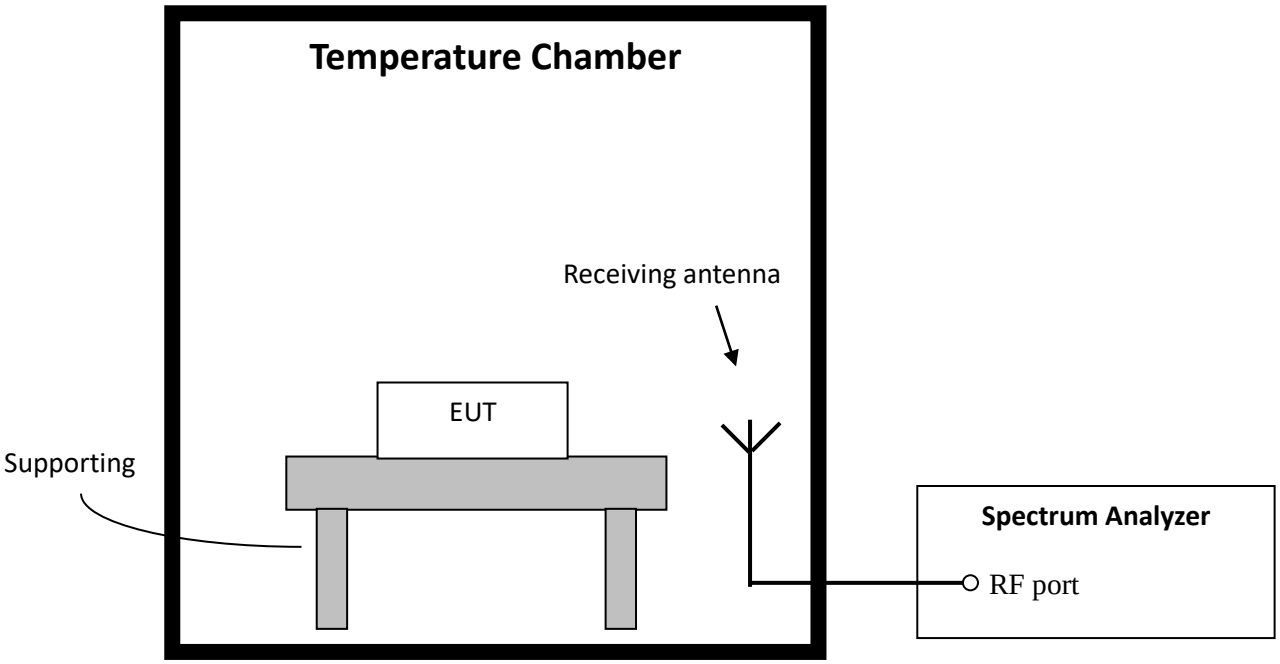
5 Frequency Stability (Temperature Variation)

Test result: PASS

5.1 Test limit

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage.

5.2 Test Configuration



5.3 Test procedure and test setup

Test Procedure as per ANSI 63.10 clause 6.8.1.

5.4 Test protocol

Voltage (V)	Temp (ºC)	Freq measured (MHz)	Freq nominal (MHz)	Tolerance (%)	Limit (%)
240	-20	13.5596	13.56	-0.003	±.01
	-10	13.5593		-0.005	
	0	13.5600		0	
	10	13.5600		0	
	20	13.5600		0	
	30	13.5601		0.001	
	40	13.5595		-0.004	
	50	13.5598		-0.001	

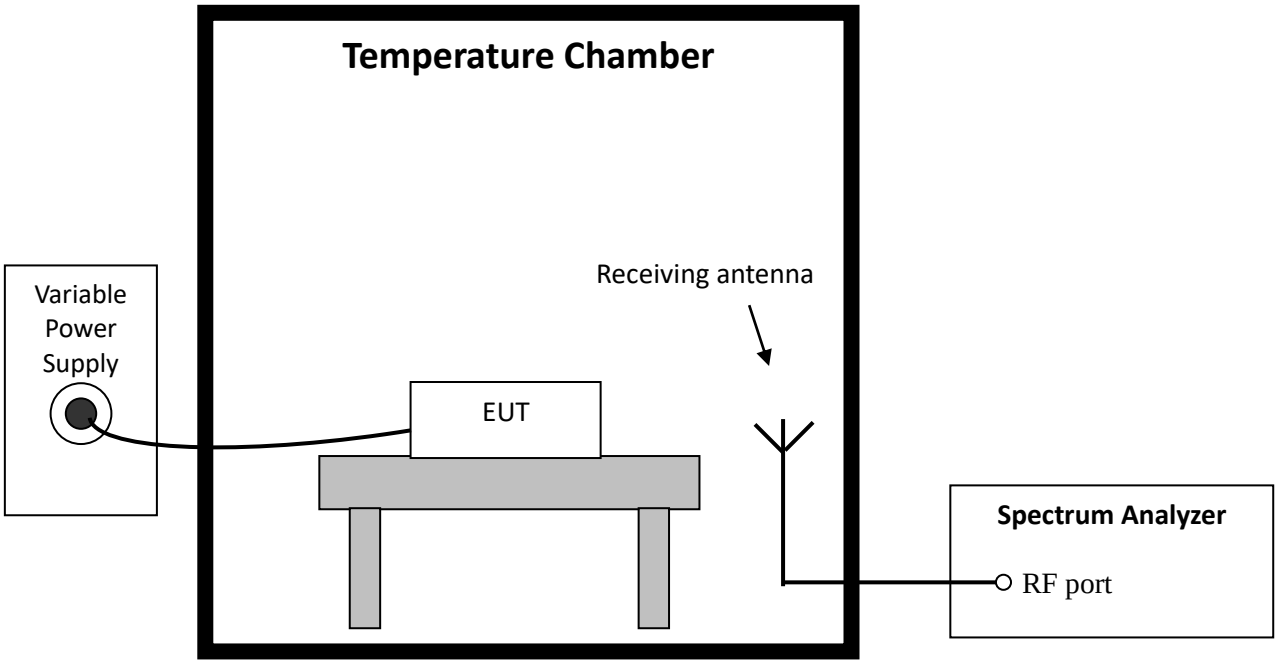
6 Frequency Stability (Voltage Variation)

Test result: PASS

6.1 Test limit

The frequency tolerance of the carrier signal shall be maintained within ±0.01% 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.

6.2 Test Configuration



6.3 Test procedure and test setup

Test Procedure as per ANSI 63.10 clause 6.8.2.

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6.4 Test protocol

Temp (ºC)	Voltage (V)	Freq Measured (MHz)	Freq nominal (MHz)	Tolerance (%)	Limit (%)
20	216	13.5603	13.56	0.002	±0.01
	240	13.5603		0.002	
	264	13.5600		0	

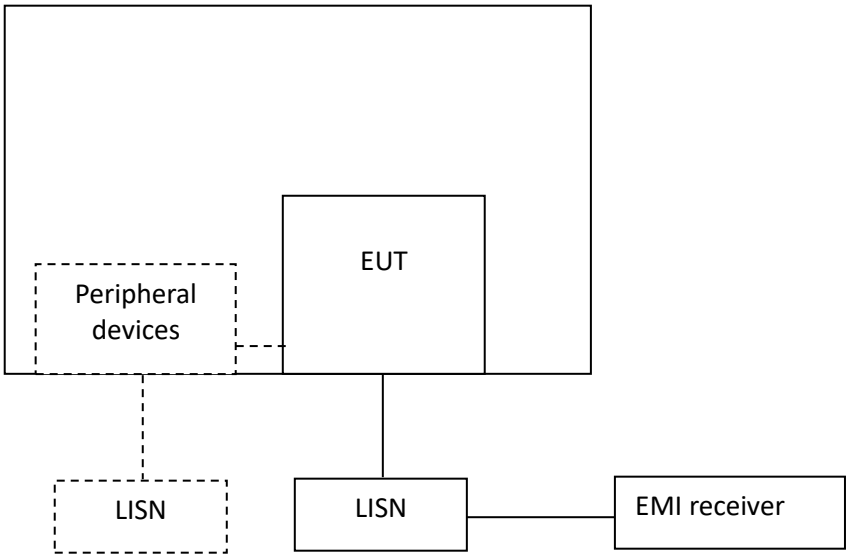
7 Conducted emissions

Test result: **Pass**

7.1 Limit

Frequency of Emission (MHz)	Conducted Emissions Limit (dBuV)	
	QP	AV
0.15-0.5	66 to 56*	56 to 46 *
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

7.2 Test Configuration



7.3 Measurement Procedure

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

The bandwidth of the test receiver is set at 9 kHz.

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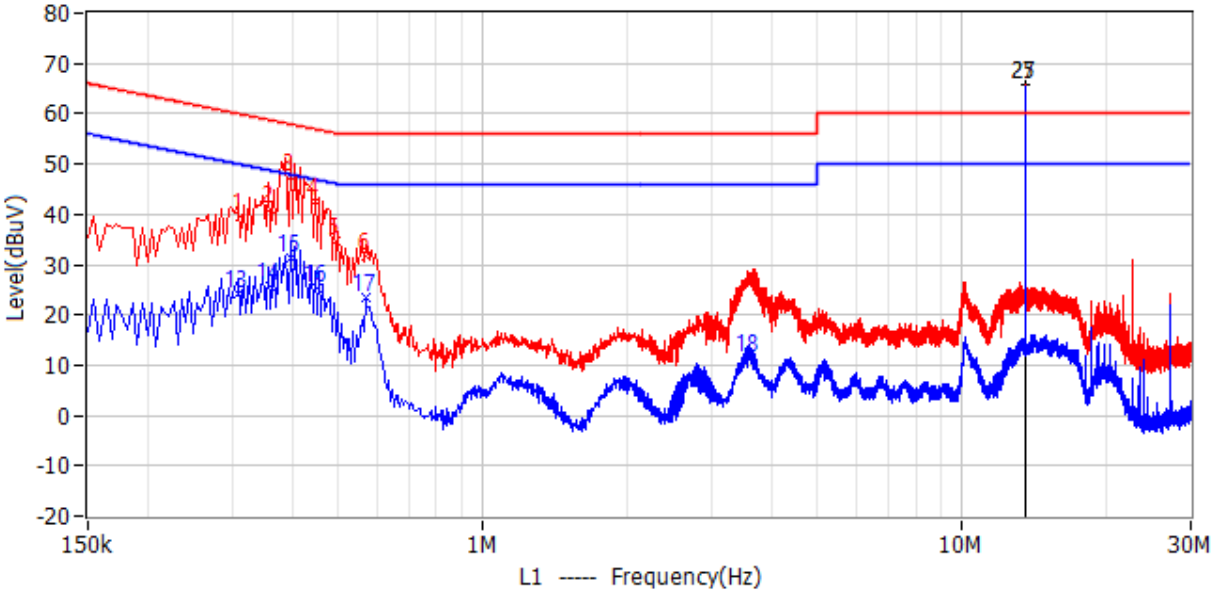
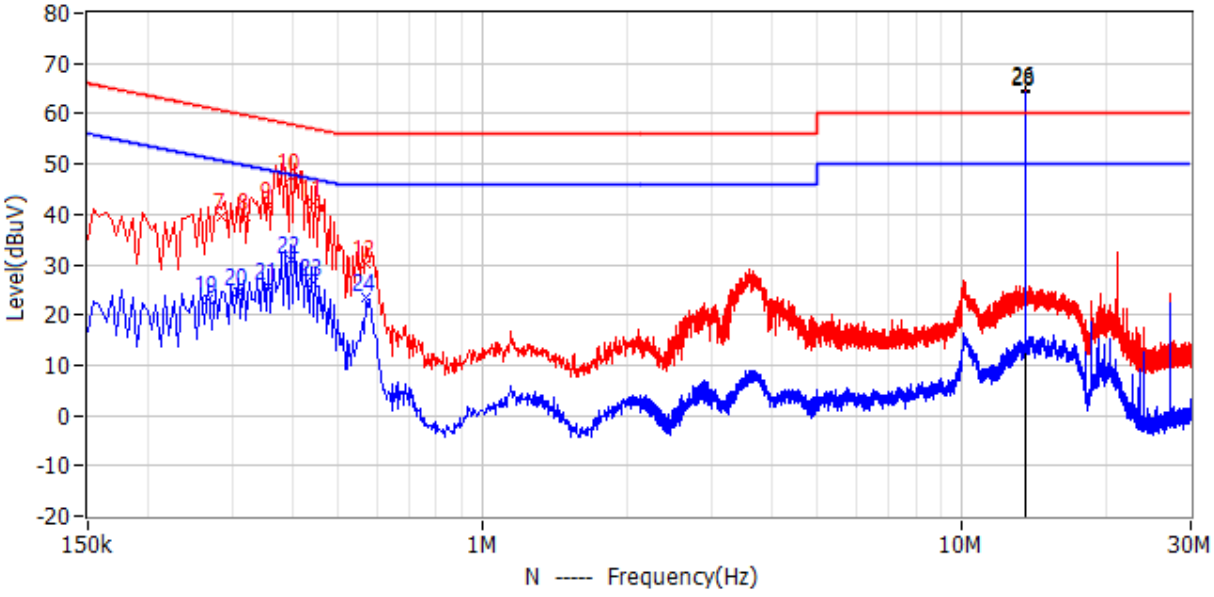
7.4 Test Results of Conducted Emissions

Test Voltage: 240VAC/60Hz
Test Curve:

L Line



N Line



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Frequency	Limit dBuV	Level dBuV	Delta dB	Detector	Phase
312.000kHz	59.9	39.4	-20.5	QP	L1
361.500kHz	58.7	40.9	-17.8	QP	L1
397.500kHz	57.9	47.6	-10.3	QP	L1
447.000kHz	56.9	42.7	-14.2	QP	L1
492.000kHz	56.1	34.6	-21.5	QP	L1
573.000kHz	56.0	31.6	-24.4	QP	L1
285.000kHz	60.7	39.4	-21.3	QP	N
321.000kHz	59.7	39.6	-20.1	QP	N
357.000kHz	58.8	41.8	-17.0	QP	N
397.500kHz	57.9	47.5	-10.4	QP	N
442.500kHz	57.0	42.0	-15.0	QP	N
573.000kHz	56.0	30.1	-25.9	QP	N
307.500kHz	50.0	24.3	-25.7	CAV	L1
361.500kHz	48.7	25.6	-23.1	CAV	L1
397.500kHz	47.9	31.2	-16.7	CAV	L1
451.500kHz	46.8	25.4	-21.4	CAV	L1
573.000kHz	46.0	23.4	-22.6	CAV	L1
3.584MHz	46.0	11.6	-34.4	CAV	L1
267.000kHz	51.2	23.1	-28.1	CAV	N
307.500kHz	50.0	24.7	-25.3	CAV	N
357.000kHz	48.8	25.7	-23.1	CAV	N
397.500kHz	47.9	31.1	-16.8	CAV	N
442.500kHz	47.0	26.6	-20.4	CAV	N
573.000kHz	46.0	23.6	-22.4	CAV	N
13.560MHz	-	-	-	-	L1
13.560MHz	-	-	-	-	N

Remark: 1. Correct Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.

2. Level = Original Receiver Reading + Correct Factor

3. Delta = Level - Limit

4. If the PK Level is lower than AV limit, the AV test can be elided.

5. the emissions of 13.56MHz are the product's RF signal.

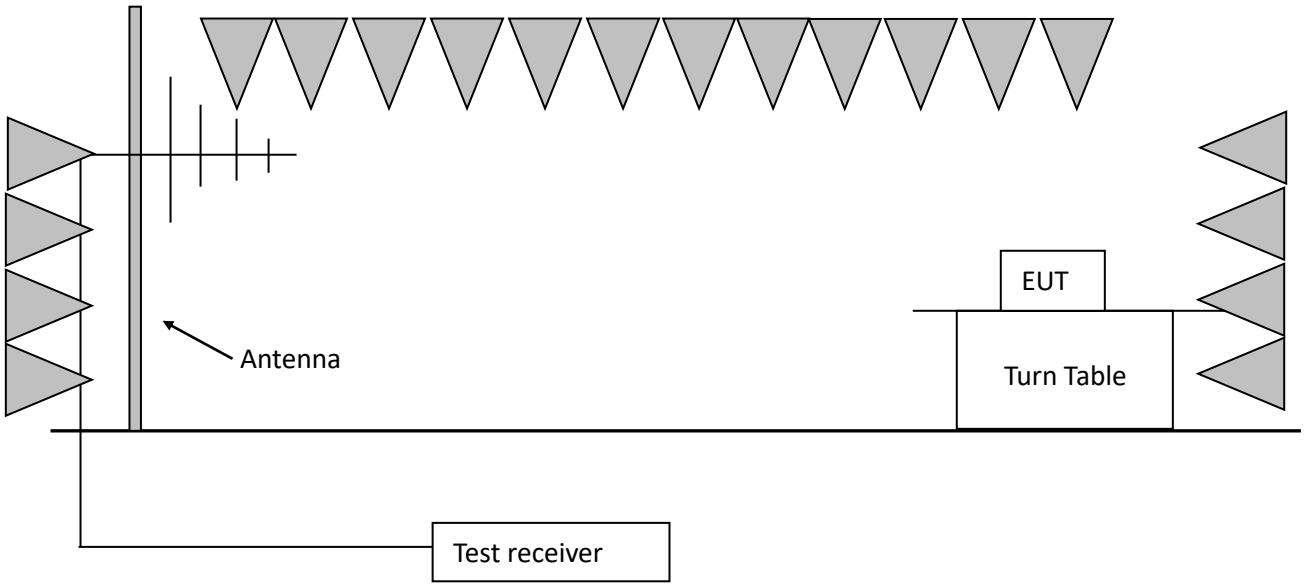
8 20dB Bandwidth

Test result: Pass

8.1 Limit

The 20dB bandwidth should be fallen in the allocated operating frequency range.
No limit for 99% bandwidth.

8.2 Test configuration



8.3 Test procedure and test set up

The measurement was applied in a 3m semi-anechoic chamber.

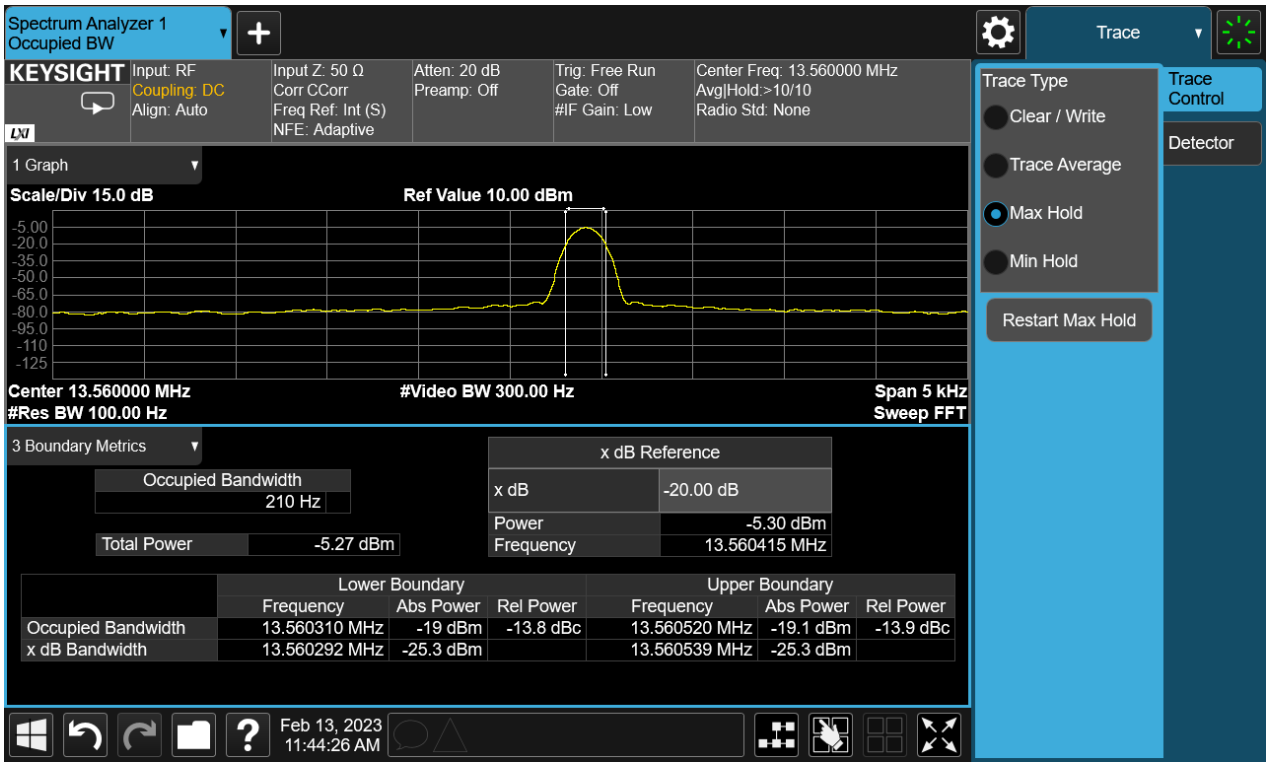
The center of the loop antenna shall be 1 m above the horizontal metal ground plane.

The following procedure shall be used for measuring (99 %) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.
2. Set RBW = 1 % to 5 % of the OBW
3. Set VBW ≥ 3 · RBW
4. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
5. Use the 99 % power bandwidth function of the instrument (if available).
6. the 20dB bandwidth is also measured with the same setting.

8.4 Test protocol

	Lower point (MHz)	Higher point (MHz)	Bandwidth (kHz)	Allocated bandwidth (MHz)
20dB Bandwidth	13.560292	13.560539	0.247	13.553 ~ 13.567
Occupied bandwidth	13.560310	13.560520	0.21	13.553 ~ 13.567



9 Antenna requirement

Requirement:
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.

Result:
EUT uses permanently attached antenna to the intentional radiator, so it can comply with the provisions of this section.

********** END **********