

**Nanjing PowerCore Technology Co., Ltd.**

# **RF TEST REPORT**

**Report Type:**

FCC Part 15.225 RF report

**Model:**

NKR-AC002

**REPORT NUMBER:**

220302566SHA-001

**ISSUE DATE:**

April 21, 2023

**DOCUMENT CONTROL NUMBER:**

TTRF15.225\_V1 © 2018 Intertek



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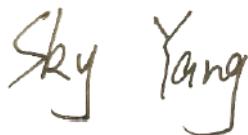
**FCC ID:** 2A98K-AC002

**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:**

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**TEST REPORT**

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**TEST REPORT****Revision History**

Report No.	Version	Description	Issued Date
220302566SHA-001	Rev. 01	Initial issue of report	April 21, 2023

**TEST REPORT****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 Electric Vehicle Charging Station
Type/Model:	NKR-AC002
Description of EUT:	The EUT is electric vehicle AC charger with RFID, WIFI and LTE function. The wireless module FCC ID is 2AC7Z-ESPWROOM32UE and XMR201903EG25G.
Rating:	Input: 240VAC $\pm$ 10%, 60Hz Output: 240V $\pm$ 10%, Max 48A*2
EUT type:	<input type="checkbox"/> Table top <input checked="" type="checkbox"/> Floor standing
Software Version:	-
Hardware Version:	-
Serial numbers:	0230303-29
Sample received date:	March 13, 2023
Date of test:	March 20, 2023 ~ March 24, 2023

**1.2 Technical Specification**

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

**TEST REPORT****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

**TEST REPORT****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

**TEST REPORT**
**2.6 Instrument list**

Conducted Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	Test Receiver	R&S	ESCS 30	EC 2107	2023-07-18
<input checked="" type="checkbox"/>	A.M.N.	R&S	ESH2-Z5	EC 3119	2023-11-09
<input checked="" type="checkbox"/>	Shielded room	Zhongyu	-	EC 2838	2024-01-10
Radiated Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	Test Receiver	R&S	ESIB 26	EC 3045	2023-07-18
<input checked="" type="checkbox"/>	Bilog Antenna	TESEQ	CBL 6112B	EC 6411	2023-08-23
<input checked="" type="checkbox"/>	Active loop antenna	Schwarzbeck	FMZB1519	EC 5345	2023-06-15
<input checked="" type="checkbox"/>	Semi-anechoic chamber	Albatross project	-	EC 3048	2023-07-08
RF test					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	Spectrum Analyzer	Keysight	N9030B	EC 6078	2023-06-04
<input type="checkbox"/>	Vector Signal Generator	Agilent	N5182B	EC 5175	2024-03-13
<input type="checkbox"/>	Universal Radio Communication Tester	R&S	CMW500	EC5944	2024-01-19
<input type="checkbox"/>	MXG Analog Signal Generator	Agilent	N5181A	EC 5338-2	2024-03-13
<input type="checkbox"/>	Mobile Test System	Litepoint	Iqxel	EC 5176	2024-01-10
<input checked="" type="checkbox"/>	Climate chamber	GWS	MT3065	EC 6021	2024-03-07
Additional instrument					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	Thermo-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3783	2024-03-24
<input checked="" type="checkbox"/>	Thermo-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3442	2024-01-02

**TEST REPORT****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

**TEST REPORT****3 Fundamental Emission****Test result:** **Pass****3.1 Limit**

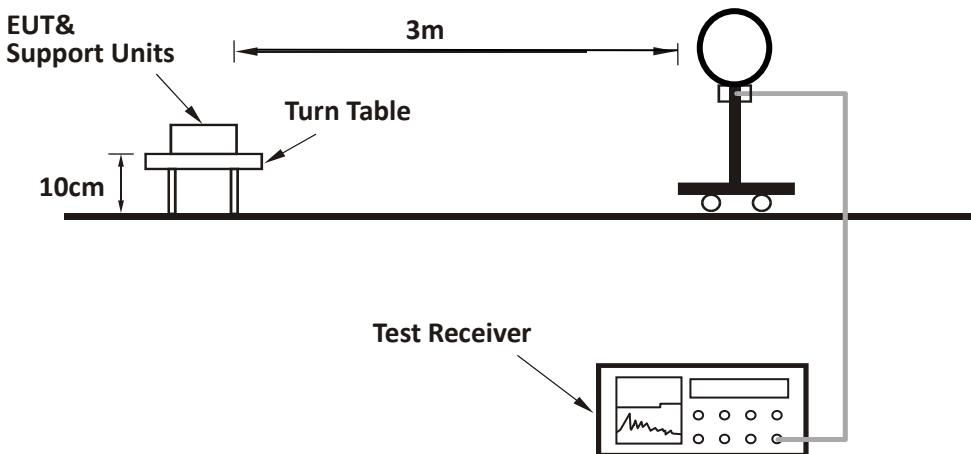
Frequencies (MHz)	Limit at 30m (dBuV/m)	Limit at 3m (dBuV/m)
13.110 – 13.410	40.50	80.50
13.410 – 13.553	50.50	90.50
13.553 – 13.567	84.00	124.00
13.567 – 13.710	50.50	90.50
13.710 – 14.010	40.50	80.50

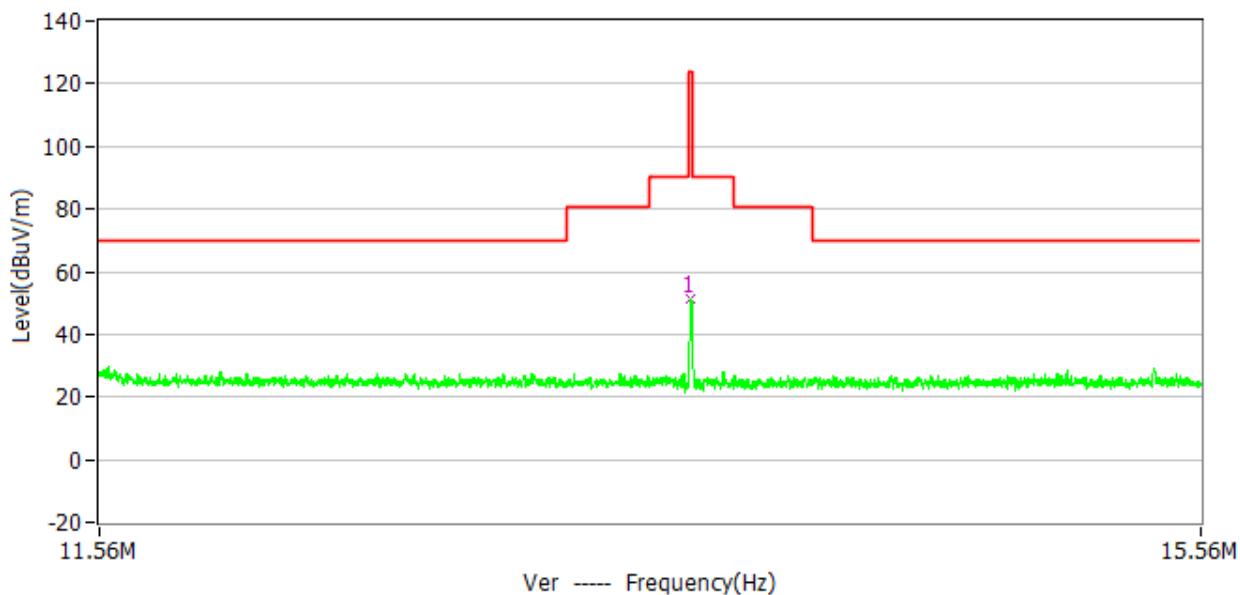
**3.2 Measurement Procedure**

- a) The EUT was placed on a 0.1m 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.

**TEST REPORT****3.3 Test Configuration**

**TEST REPORT**
**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	52.9	20.4	124.00	71.1	PK
Y	13.56	51.1	20.4	124.00	72.9	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 =  $30.20 + 2.00 - 32.00 = 0.20$ dB/m;  
 Corrected Reading =  $10\text{dBuV} + 0.20\text{dB/m} = 10.20\text{dBuV/m}$ ;  
 Margin =  $40.00\text{dBuV/m} - 10.20\text{dBuV/m} = 29.80\text{dB}$ .

**TEST REPORT****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 0.1m 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 0.1m 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.

**TEST REPORT**

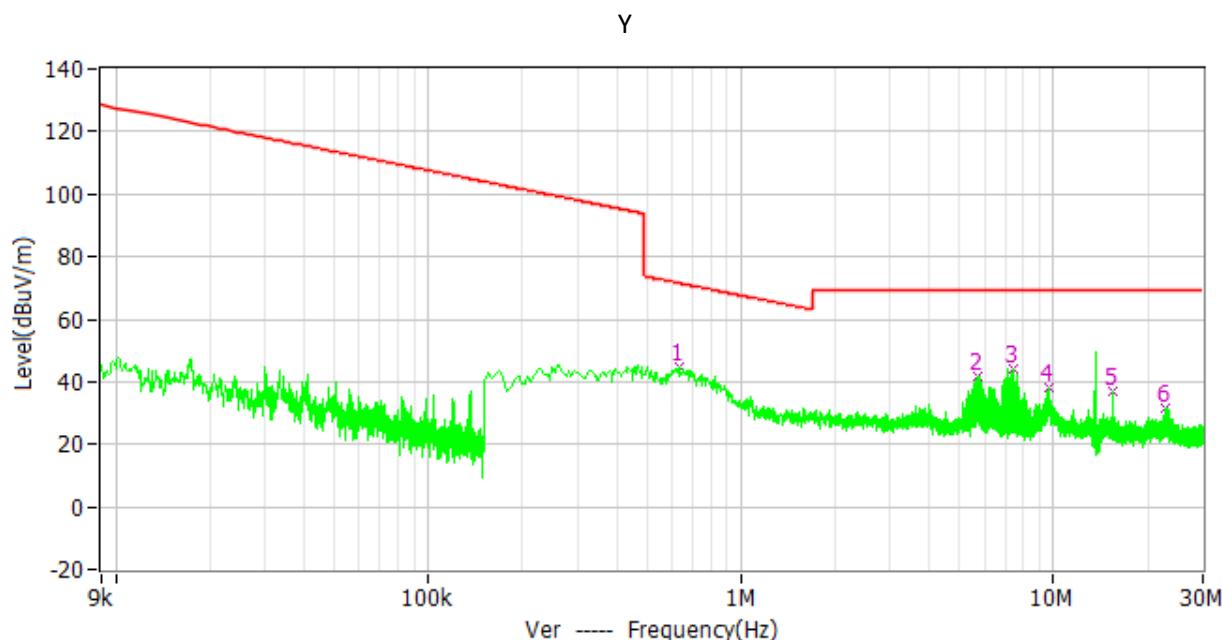
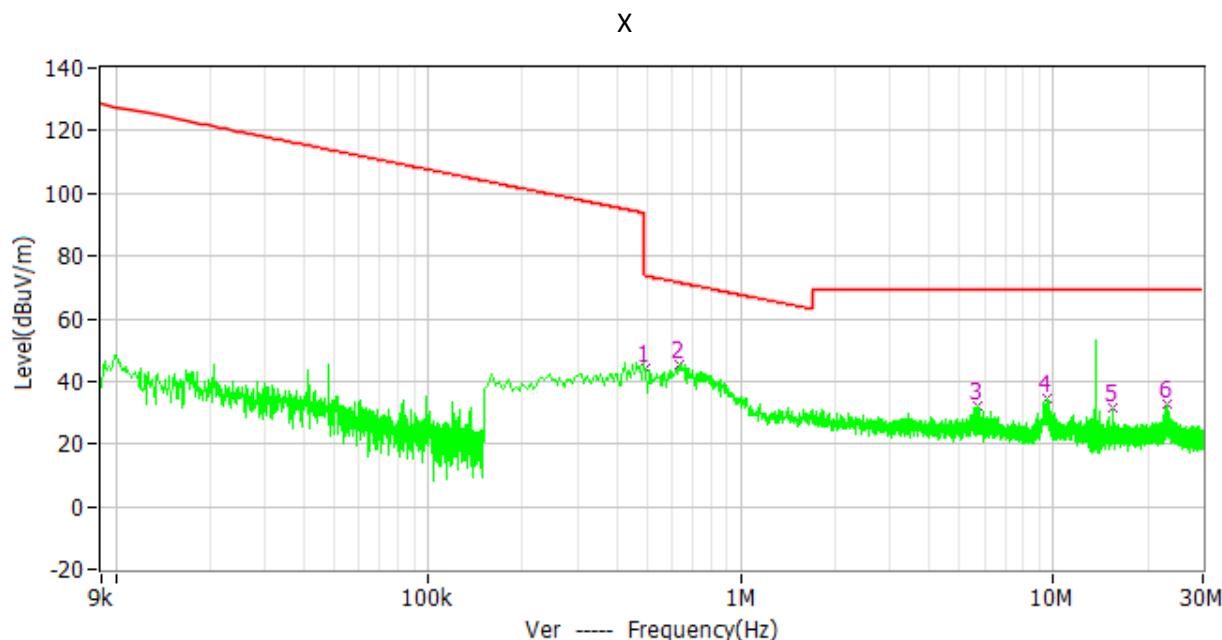
- d) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e) The test-receiver system was set to quasi-peak detect function 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

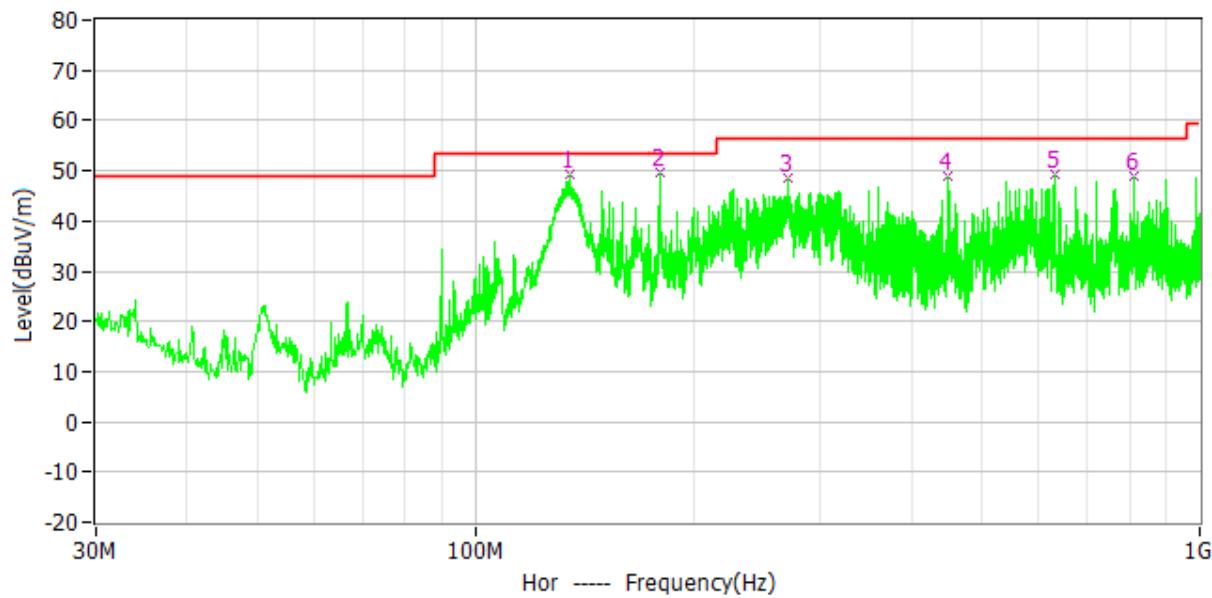
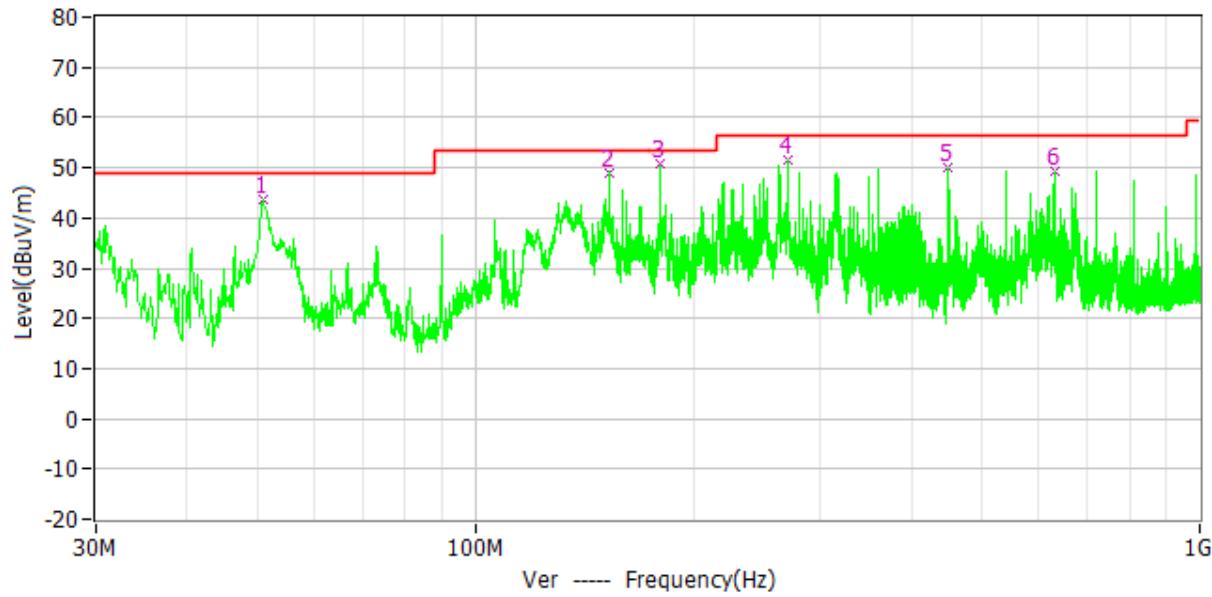
**TEST REPORT****4.3 Test Results of Radiated Emissions**

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:**

**TEST REPORT****Test data below 30MHz:**

Frequency	Limit (dBuV/m)	Corrected Reading (dBuV/m)	Margin	Detector	Polarity
496.500kHz	73.7	44.4	-29.3	PK	X
636.000kHz	71.5	45.5	-26.0	PK	X
5.717MHz	69.5	32.2	-37.3	PK	X
9.551MHz	69.5	34.5	-35.0	PK	X
15.365MHz	69.5	31.4	-38.1	PK	X
22.934MHz	69.5	33.0	-36.5	PK	Y
631.500kHz	71.6	44.7	-26.9	PK	Y
5.744MHz	69.5	41.9	-27.6	PK	Y
7.445MHz	69.5	44.3	-25.2	PK	Y
9.596MHz	69.5	37.9	-31.6	PK	Y
15.365MHz	69.5	37.1	-32.4	PK	Y
22.682MHz	69.5	31.8	-37.7	PK	Y

**TEST REPORT****H****V**

**TEST REPORT**
**Test data from 30MHz to 1000MHz:**

Antenna Polarization	Frequency	Limit (dBuV/m)	Corrected Reading (dBuV/m)	Margin	Detector
H	134.954MHz	53.5	49.4	4.1	PK
H	179.962MHz	53.5	49.6	3.9	PK
H	269.978MHz	56.5	48.7	7.8	PK
H	449.913MHz	56.5	48.9	7.6	PK
H	629.945MHz	56.5	49.4	7.1	PK
H	809.977MHz	56.5	49.0	7.5	PK
V	50.952MHz	49.0	43.8	5.2	PK
V	153.287MHz	53.5	49.1	4.4	PK
V	179.962MHz	53.5	50.5	3.0	PK
V	269.978MHz	56.5	50.9	5.6	PK
V	450.010MHz	56.5	50.2	6.3	PK
V	629.945MHz	56.5	49.4	7.1	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.

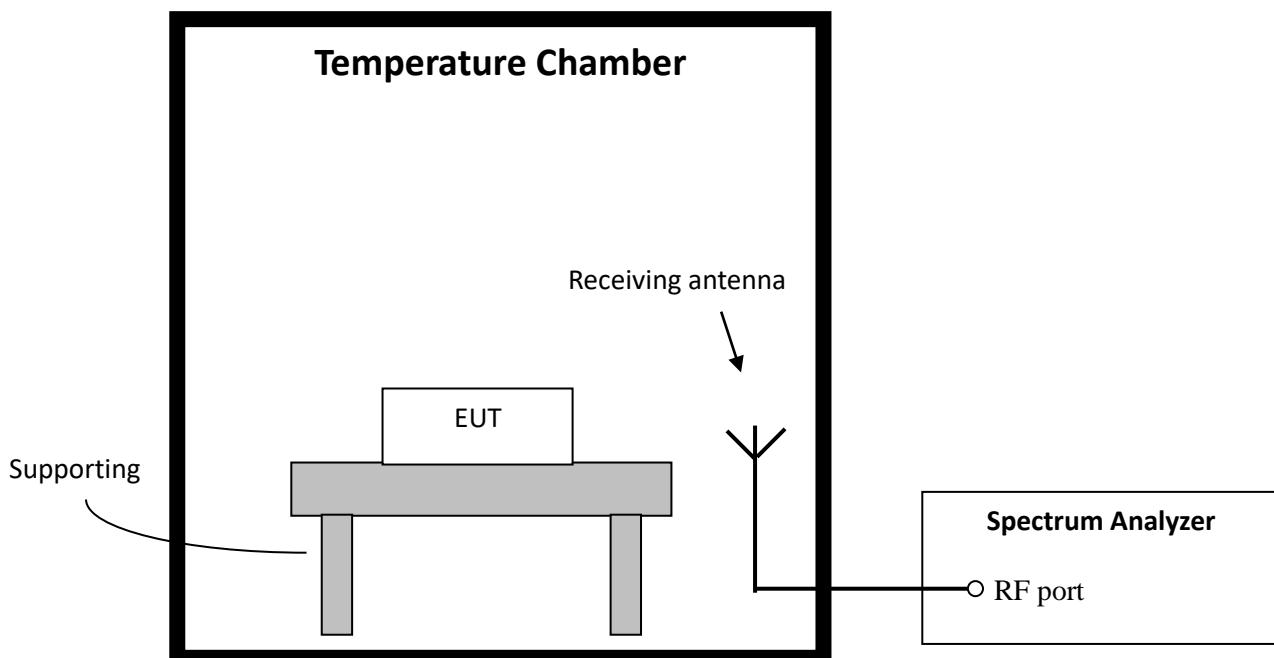
Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,  
 Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV,  
 Limit = 40.00dBuV/m.  
 Then Correct Factor =  $30.20 + 2.00 - 32.00 = 0.20$ dB/m;  
 Corrected Reading =  $10\text{dBuV} + 0.20\text{dB/m} = 10.20\text{dBuV/m}$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

**TEST REPORT****5 Frequency Stability (Temperature Variation)**

**Test result: PASS**

**5.1 Test limit**

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

**5.2 Test Configuration**

**TEST REPORT****5.3 Test procedure and test setup**

Test Procedure as per ANSI 63.10 clause 6.8.1.

**5.4 Test protocol**

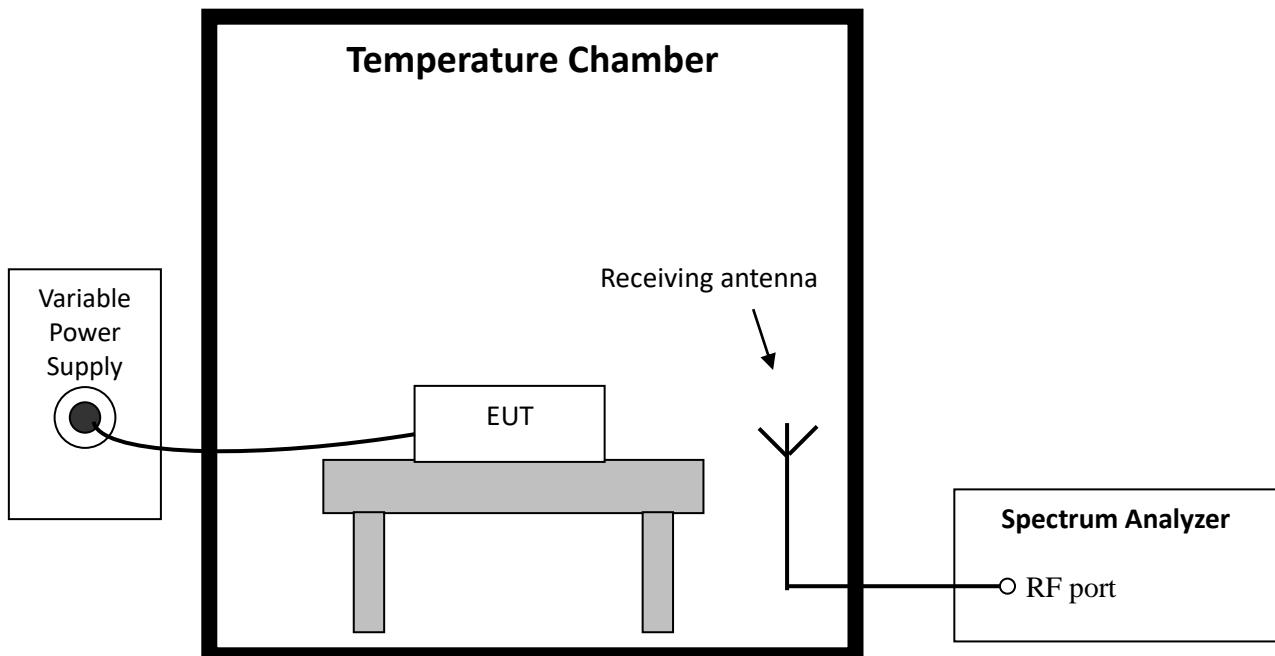
Voltage (V)	Temp (°C)	Freq measured (MHz)	Freq nominal (MHz)	Tolerance (%)	Limit (%)
240	-20	13.5593	13.56	-0.005	±.01
	-10	13.5597		-0.002	
	0	13.5600		0	
	10	13.5600		0	
	20	13.5600		0	
	30	13.5602		0.001	
	40	13.5592		-0.006	
	50	13.5596		-0.003	

**TEST REPORT****6 Frequency Stability (Voltage Variation)**

**Test result: PASS**

**6.1 Test limit**

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  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.

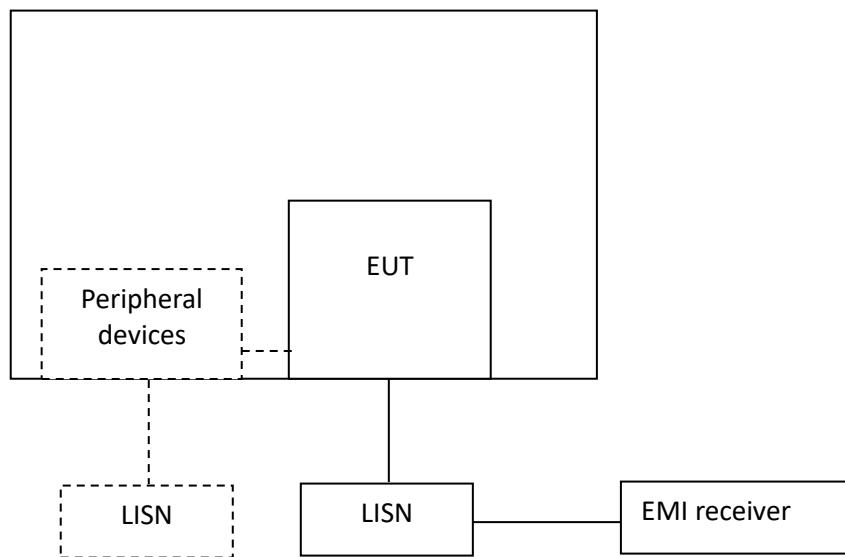
**TEST REPORT****6.4 Test protocol**

Temp (°C)	Voltage (V)	Freq Measured (MHz)	Freq nominal (MHz)	Tolerance (%)	Limit (%)
20	216	13.5604	13.56	0.003	±0.01
	240	13.5600		0	
	264	13.5603		0.002	

**TEST REPORT****7 Conducted emissions**Test result: **Pass****7.1 Limit**

Frequency of Emission (MHz)	Conducted Emissions Limit (dBuV)	
	QP	AV
0.15 ~ 0.5	79	66
0.5 ~ 30	73	60

\* Decreases with the logarithm of the frequency.

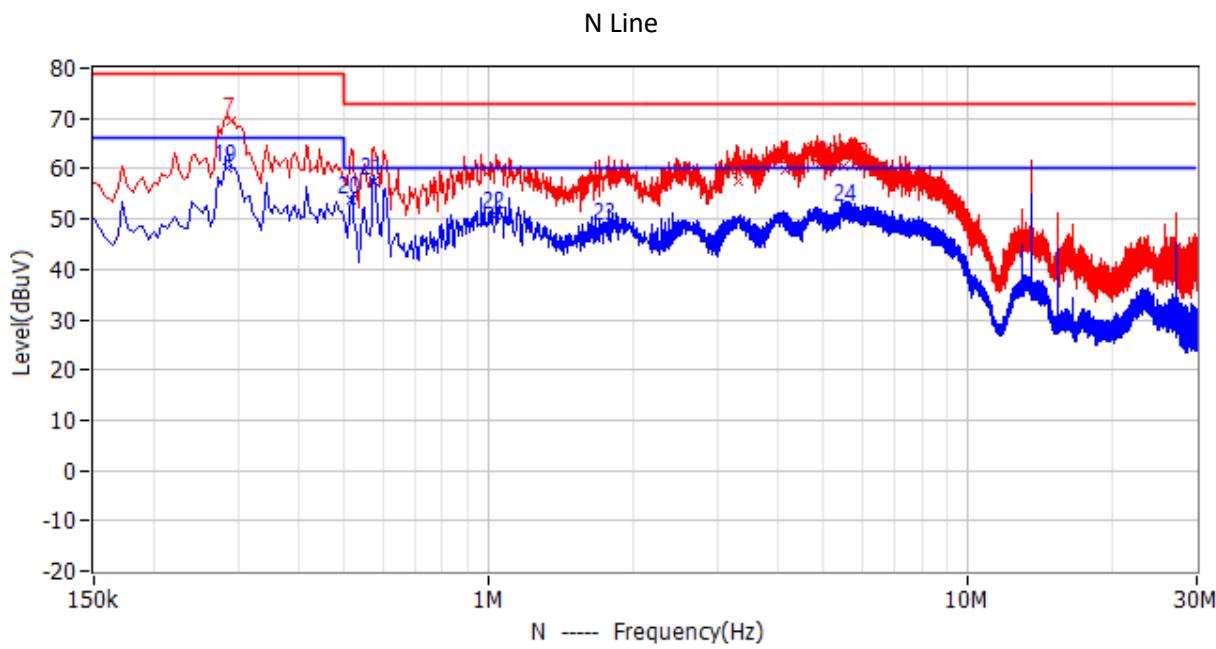
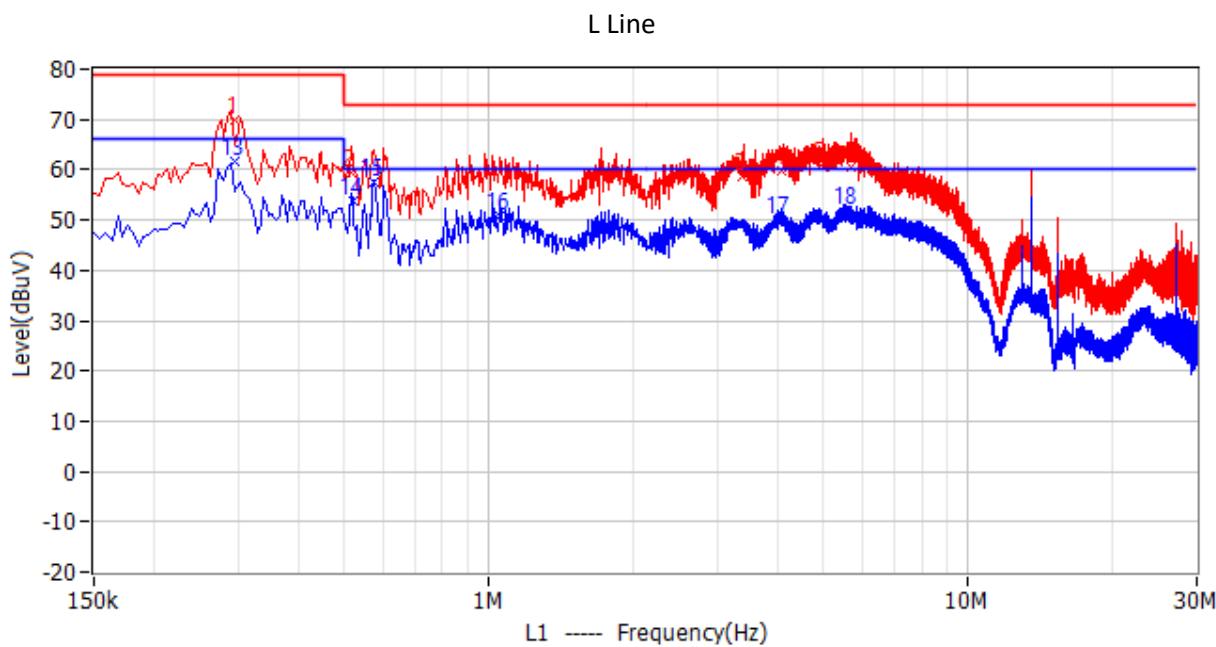
**7.2 Test Configuration**

**TEST REPORT****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  $50\ \Omega$  LISN port (to which the EUT is connected), where permitted, terminated into a  $50\ \Omega$  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  $50\ \Omega$  measuring port is terminated by a measuring instrument having  $50\ \Omega$  input impedance. All other ports are terminated in  $50\ \Omega$  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.

**TEST REPORT****7.4 Test Results of Conducted Emissions****Test Voltage: 240VAC/60Hz****Test Curve:**

**TEST REPORT**

Frequency	Limit dBuV	Level dBuV	Delta dB	Detector	Phase
294.000kHz	79.0	69.9	-9.1	QP	L1
514.500kHz	73.0	59.5	-13.5	QP	L1
3.372MHz	73.0	58.6	-14.4	QP	L1
4.092MHz	73.0	59.6	-13.4	QP	L1
4.943MHz	73.0	61.0	-12.0	QP	L1
5.694MHz	73.0	60.5	-12.5	QP	L1
289.500kHz	79.0	69.6	-9.4	QP	N
3.314MHz	73.0	57.7	-15.3	QP	N
4.146MHz	73.0	59.9	-13.1	QP	N
4.880MHz	73.0	61.0	-12.0	QP	N
5.478MHz	73.0	60.5	-12.5	QP	N
5.951MHz	73.0	60.4	-12.6	QP	N
294.000kHz	66.0	61.8	-4.2	CAV	L1
519.000kHz	60.0	53.7	-6.3	CAV	L1
577.500kHz	60.0	57.6	-2.4	CAV	L1
1.055MHz	60.0	50.9	-9.1	CAV	L1
4.047MHz	60.0	50.2	-9.8	CAV	L1
5.591MHz	60.0	51.9	-8.1	CAV	L1
285.000kHz	66.0	60.2	-5.8	CAV	N
514.500kHz	60.0	53.8	-6.2	CAV	N
577.500kHz	60.0	57.6	-2.4	CAV	N
1.032MHz	60.0	50.9	-9.1	CAV	N
1.770MHz	60.0	48.7	-11.3	CAV	N
5.591MHz	60.0	52.2	-7.8	CAV	N

*Remark:*

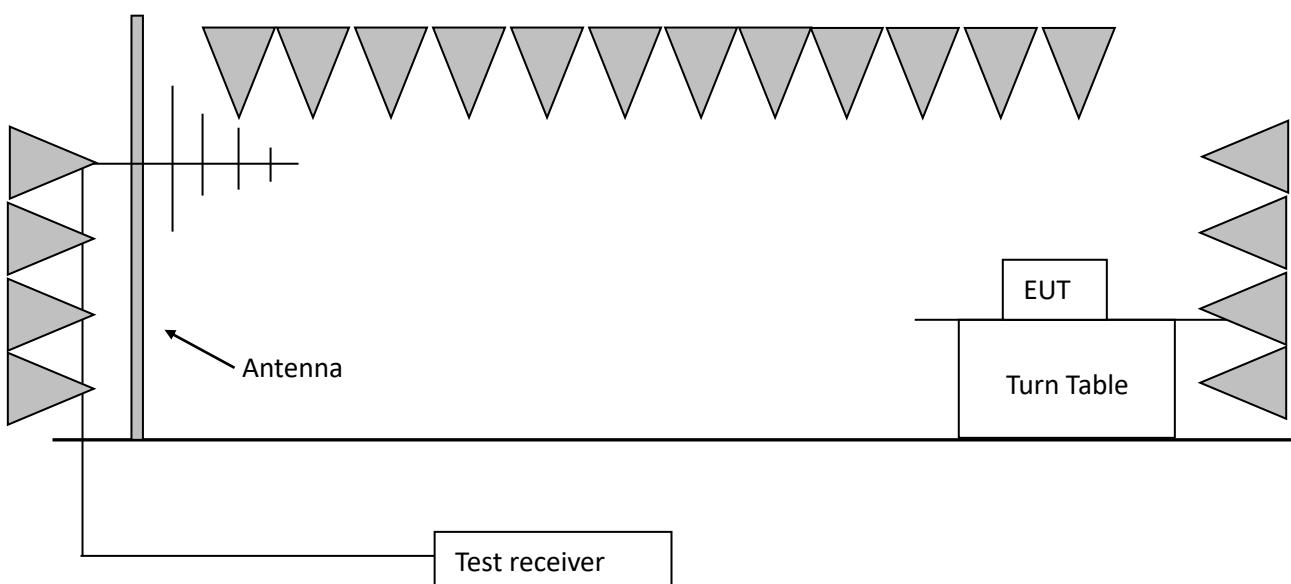
1. *Correct Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.*
2. *Level = Original Receiver Reading + Correct Factor*
3. *Delta = Level - Limit*
4. *If the PK Level is lower than AV limit, the AV test can be elided.*
5. *the emissions of 13.56MHz are the product's RF signal.*

**TEST REPORT****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**

**TEST REPORT****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  $\geq 3 \cdot \text{RBW}$
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.

## TEST REPORT

### 8.4 Test protocol

	Lower point (MHz)	Higher point (MHz)	Bandwidth (kHz)	Allocated bandwidth (MHz)
20dB Bandwidth	13.560278	13.561141	0.863	13.553 ~ 13.567
Occupied bandwidth	13.559209	13.562081	2.872	13.553 ~ 13.567



**TEST REPORT**

## 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 \*\*\*\*\*