

## FCC TEST REPORT

### No. 160501886SHA-001

Applicant : Telehems Labs Corporation  
45401 Reaserch Ave, Suite 208, Fremont, CA  
94539

Manufacturer : Hangzhou Telehems Electronics Technology Co.,  
Ltd.  
1601 Tianheng Building, 1509 Binsheng Road,  
Binjiang, Hangzhou, Zhejiang, China

Product Name : Telehems Key

Type/Model : HEMS-BK2

**TEST RESULT : PASS**

### SUMMARY

The equipment complies with the requirements according to the following standard(s) or specification:

**47CFR Part 15 (2015):** Radio Frequency Devices (Subpart C)

**ANSI C63.10 (2013):** American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

Date of issue: June 2, 2016

Prepared by:



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Reviewed by:



Daniel Zhao (*Reviewer*)



## Description of Test Facility

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## **1 GENERAL INFORMATION**

### **1.1 Description of Client**

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Manufacturer : Hangzhou Telehems Electronics Technology Co., Ltd.  
1601 Tianheng Building, 1509 Binsheng Road, Binjiang,  
Hangzhou, Zhejiang, China

### **1.2 Identification of the EUT**

Product Name : Telehems Key  
Type/model : HEMS-BK2  
FCC ID : 2AIKN-HEMSBK2

### 1.3 Technical Specification

Operation Frequency : 2400-2483.5MHz  
Band  
Type of Modulation : GFSK  
EUT Modes of : Bluetooth 4.0 Low Energy  
Modulation  
Channel Number : 40 channels  
Description of EUT : EUT has only one model.  
Port identification : None  
Antenna : PCB antenna, 1dBi  
Rating : DC 3.0V  
EUT type : ☒ Table top  
☐ Floor standing  
Sample received date : May 17, 2016  
Date of test : May 17, 2016 ~ June 2, 2016

## 2 TEST SPECIFICATIONS

### 2.1 Standards or specification

47CFR Part 15 (2015)  
ANSI C63.10 (2013)

### 2.2 Mode of operation during the test

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied. It was set up and tested in three axes (X, Y and Z) as its normal use.

### 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.	Name	Band and Model	Description
-	-	-	-
-	-	-	-

## 2.5 Instrument list

Selected	Instrument	EC no.	Model	Valid until date
<input type="checkbox"/>	Shielded room	EC 2838	GB88	2017-1-8
<input type="checkbox"/>	EMI test receiver	EC 2107	ESCS 30	2016-10-19
<input type="checkbox"/>	A.M.N.	EC 3119	ESH2-Z5	2016-12-16
<input type="checkbox"/>	A.M.N.	EC 3394	ENV 216	2016-8-1
<input checked="" type="checkbox"/>	Semi anechoic chamber	EC 3048	-	2017-5-11
<input checked="" type="checkbox"/>	EMI test receiver	EC 3045	ESIB26	2016-10-19
<input checked="" type="checkbox"/>	Broadband antenna	EC 4206	CBL 6112D	2017-4-27
<input checked="" type="checkbox"/>	Horn antenna	EC 3049	HF906	2017-4-27
<input type="checkbox"/>	Horn antenna	EC 4792-1	3117	2017-4-21
<input type="checkbox"/>	Horn antenna	EC 4792-3	HAP18-26W	2016-6-11
<input checked="" type="checkbox"/>	Pre-amplifier	EC 5262	pre-amp 18	2017-5-25
<input type="checkbox"/>	Pre-amplifier	EC 4792-2	TPA0118-40	2017-4-10
<input type="checkbox"/>	Test Receiver	EC 4501	ESCI 7	2017-1-13
<input type="checkbox"/>	PXA Signal Analyzer	EC5338	N9030A	2016-11-17
<input type="checkbox"/>	Power sensor/Power meter	EC4318	N1911A/N1921A	2017-4-8
<input type="checkbox"/>	Power sensor	EC5338-1	U2021XA	2017-3-5
<input type="checkbox"/>	MXG Analog Signal Generator	EC5338-2	N5181A	2017-3-5
<input type="checkbox"/>	MXG Vector Signal Generator	EC5175	N51812B	2017-1-8

## 2.6 Test Summary

**This report applies to tested sample only. The test results have been compared directly with the limits, and the measurement uncertainty is recorded. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.**

TEST ITEM	FCC REFERENCE	RESULT
Radiated emission	15.249 & 15.209	Pass
Assigned bandwidth (20dB bandwidth)	15.215(c)	Pass
Power line conducted emission	15.207	NA

Notes: 1: NA =Not Applicable

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### 3 Radiated emission

**Test result:** Pass

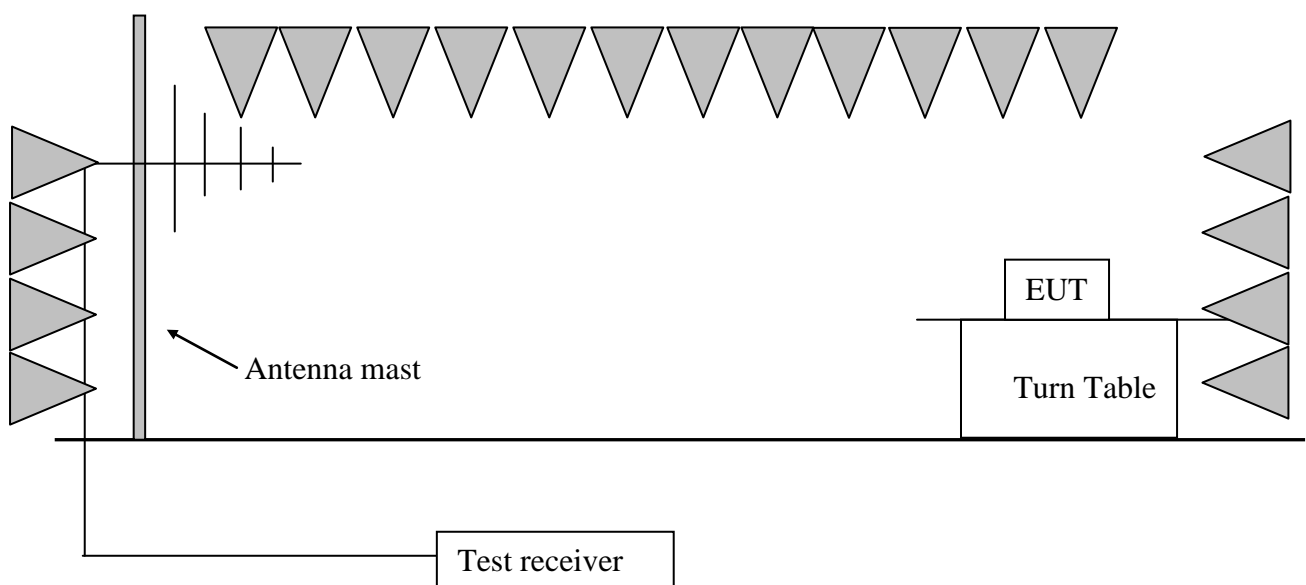
#### 3.1 Test limit

Fundamental Frequency (MHz)	Fundamental limit (dBuV/m)	Harmonic limit (dBuV/m)
<input type="checkbox"/> 902 - 928	94	54
<input checked="" type="checkbox"/> 2400 - 2483.5	94	54
<input type="checkbox"/> 5725 - 5875	94	54
<input type="checkbox"/> 24000 - 24250	108	68

The radiated emissions which fall outside allocated band (2400-2483.5MHz), must also comply with the radiated emission limits specified in §15.209(a) showed as below:

Frequency (MHz)	Field Strength (dBuV/m)	Measurement Distance (m)
30 - 88	40.0	3
88 - 216	43.5	3
216 - 960	46.0	3
Above 960	54.0	3

#### 3.2 Test Configuration



### 3.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, if applied, the pre-amplifier would be equipped just at the output terminal of the antenna.

Tabletop devices shall be placed on a nonconducting platform with nominal top surface dimensions 1 m by 1.5 m. For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m.

The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1 meter to 4 meters to find out the maximum emission level.

The radiated emission was measured using the Spectrum Analyzer with the resolutions bandwidth set as:

RBW = 300 Hz, VBW = 1 kHz (9 kHz~150 kHz);

RBW = 10 kHz, VBW = 30 kHz (150 kHz~30MHz);

RBW = 100 kHz, VBW = 300 kHz (30MHz~1GHz for PK)

RBW = 1MHz, VBW = 3MHz (>1GHz for PK);

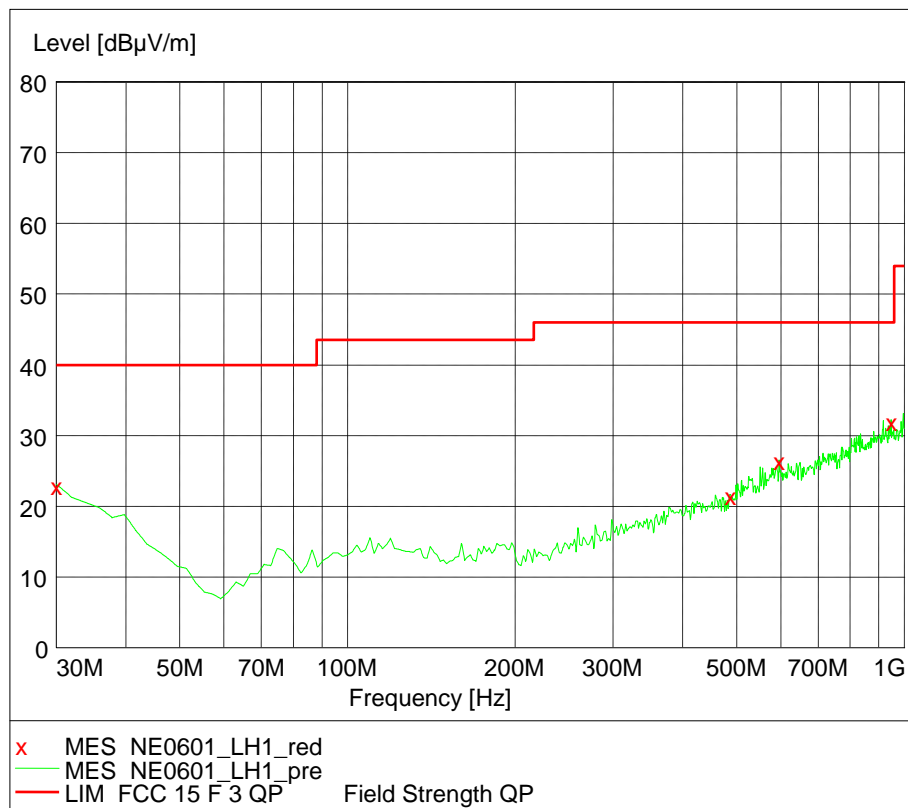
### 3.4 Test protocol

Temperature : 22 °C  
Relative Humidity : 52 %

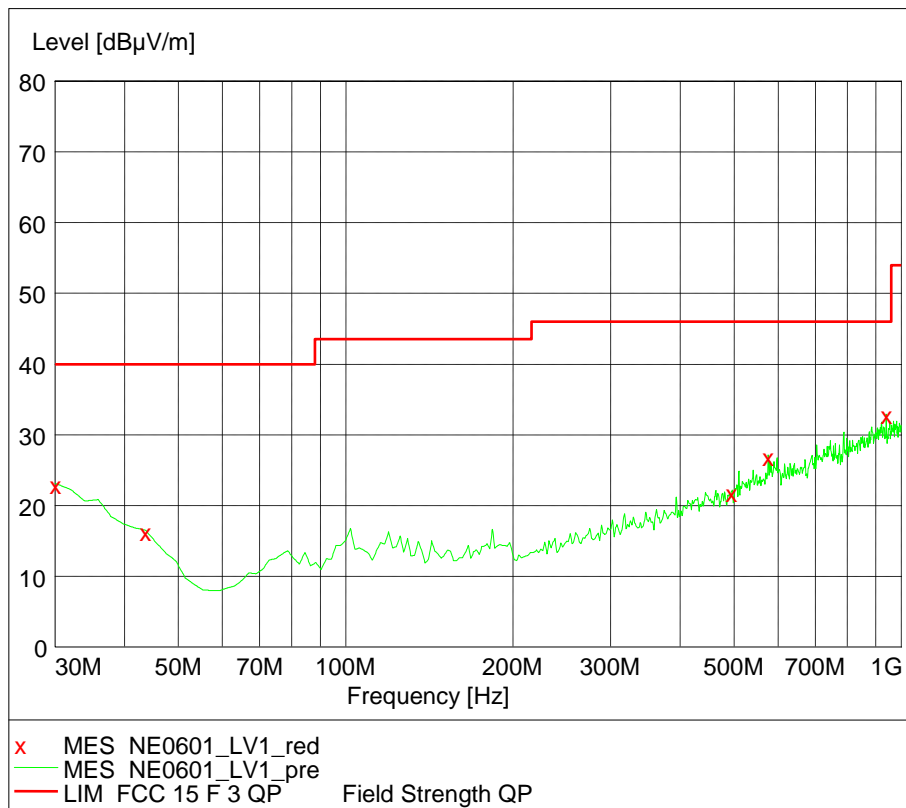
The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

The worst waveform from 30MHz to 1000MHz is listed as below:

Horizontal



### Vertical



Note: The worst test result (30MHz to 1GHz) of channel L (2402MHz) chosen to list in the report as representative.

### Test result from 30MHz to 1000MHz:

Polarization	Frequency (MHz)	Corrected Reading (dBμV/m)	Correct Factor (dB/m)	Limit (dBμV/m)	Margin (dB)	Detector
H	30.00	23.10	21.4	40.00	16.90	PK
	595.67	26.60	21.4	46.00	19.40	PK
	947.52	32.20	26.1	46.00	13.80	PK
V	30.00	23.10	21.4	40.00	16.90	PK
	576.23	27.10	21.5	46.00	18.90	PK
	939.74	32.90	26.1	46.00	13.10	PK

**Test result above 1GHz:**

CH	Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	H	2402.20	34.34	82.72	114.00	31.28	PK
	H	2400.00	34.29	53.63	74.00	20.37	PK
	H	7206.65	2.30	52.70	74.00	21.30	PK
M	H	2440.18	34.48	80.58	114.00	33.42	PK
	H	7320.68	2.30	51.60	74.00	22.40	PK
H	H	2480.16	34.62	78.70	114.00	35.40	PK
	H	2483.52	34.63	50.68	74.00	23.32	PK
	H	7328.66	2.30	50.70	74.00	23.30	PK

**Remark:**

1. Correct Factor = Antenna Factor + Cable Loss (-Amplifier, is employed);
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 = 10dBuV,  
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m,  
Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m,  
Assuming limit = 54dBuV/m, Corrected Reading = 10.20dBuV/m,  
Then Margin = 54 - 10.20 = 43.80dBuV/m.

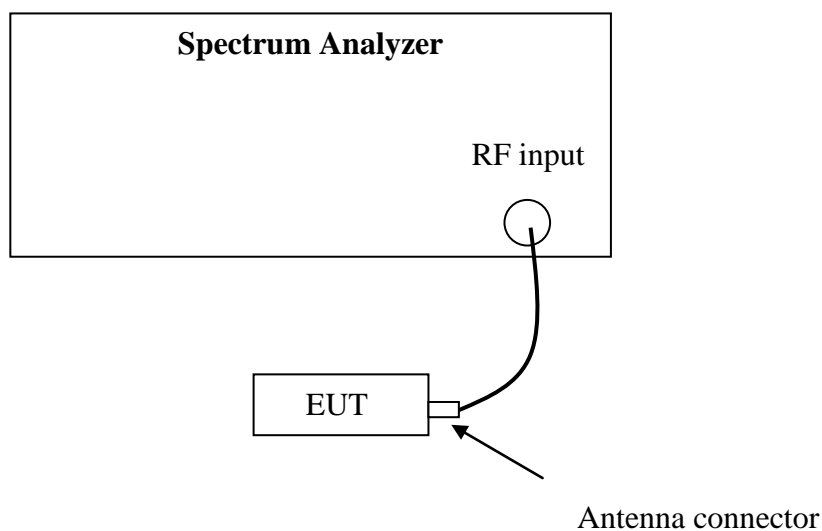
## 4 Assigned bandwidth (20dB bandwidth)

**Test result:** Pass

### 4.1 Limit

Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emission is contained within the allocated frequency band.

### 4.2 Test Configuration



### 4.3 Test procedure and test setup

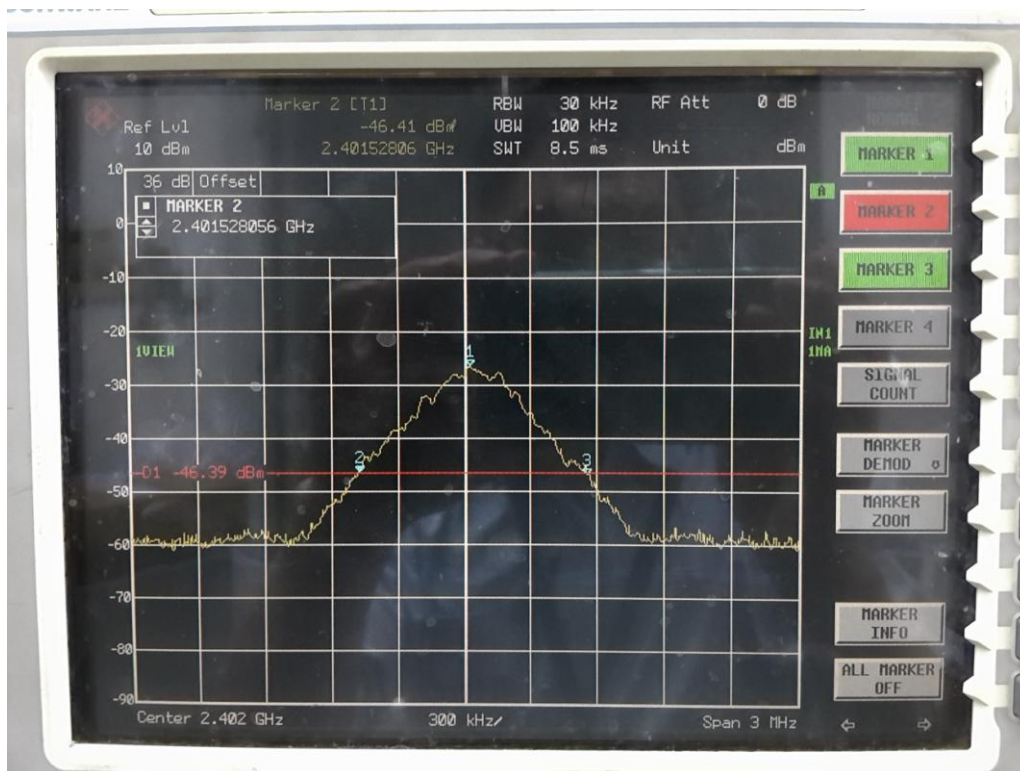
The 20dB Bandwidth per FCC § 15.215(c) is measured using the Spectrum Analyzer. Set Span = 2 to 3 times the 20 dB bandwidth, RBW = approximately 1% of the 20 dB bandwidth, VBW > RBW, Sweep = auto, Detector = peak, Trace = max hold. The test was performed at 3 channels (lowest, middle and highest channel).

#### 4.4 Test protocol

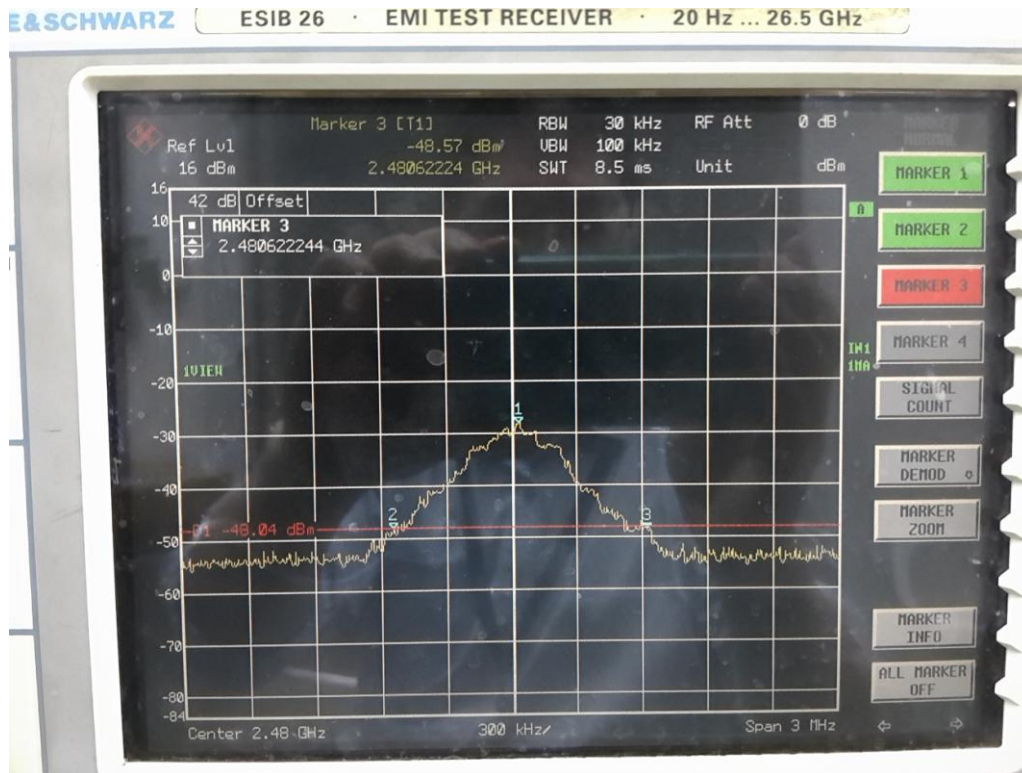
Temperature : 22 °C  
Relative Humidity : 54 %

Mode	20dB Bandwidth		Permitted Bandwidth (MHz)	Result
	F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)		
BLE	2401.53	2480.62	2400-2483.5	Pass

Channel L



Channel H



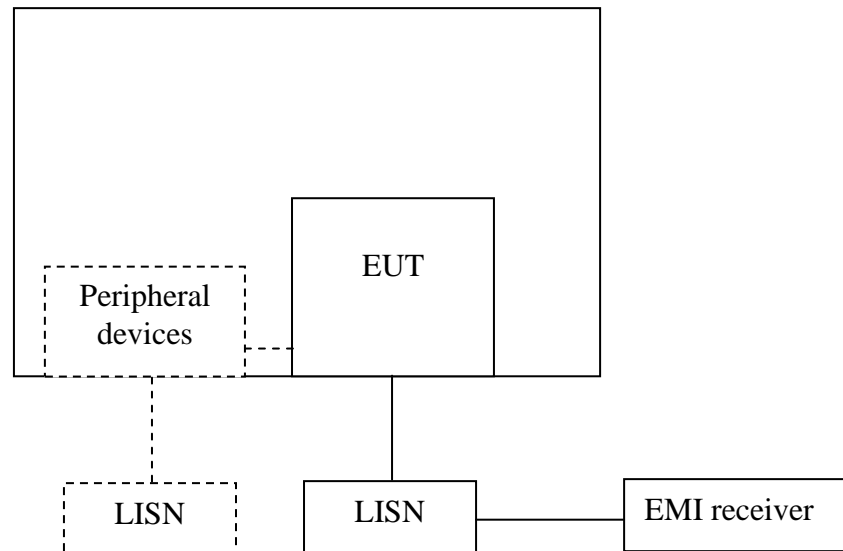
## 5 Power line conducted emission

**Test result:** NA

### 5.1 Limit

Frequency of Emission (MHz)	Conducted 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.		

### 5.2 Test configuration



- ☐ For table top equipment, wooden support is 0.8m height table
- ☐ For floor standing equipment, wooden support is 0.1m height rack.

### 5.3 Test procedure and test set up

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.

#### 5.4 Test protocol

Temperature : °C  
Relative Humidity : %

L line

Test Data:

Frequency (MHz)	Quasi-peak			Average		
	level dB(μV)	Limit dB(μV)	Margin (dB)	level dB(μV)	limit dB(μV)	Margin (dB)

N line

Test Data:

Frequency (MHz)	Quasi-peak			Average		
	level dB(μV)	Limit dB(μV)	Margin (dB)	level dB(μV)	limit dB(μV)	Margin (dB)