



TEST REPORT

No.I23N01234-EMC

for

TCL Communication Ltd.

LINKHUB

Model Name: HH40L2

With

Hardware Version: TZ7.823.397

Software Version: HH40L2.1.01

FCC ID:2ACCJB202

Issued Date: 2023-07-19

Designation Number: CN1210

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of SAICT.

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No.I23N01234-EMC

REPORT HISTORY

Report Number	Revision	Description	Issue Date
I23N01234-EMC	Rev.0	1st edition	2023-07-19

Note: the latest revision of the test report supersedes all previous version.

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1. SUMMARY OF TEST REPORT

1.1. Test Items

Description	LINKHUB
Model Name	HH40L2
Applicant's name	TCL Communication Ltd.
Manufacturer's Name	TCL Communication Ltd.

1.2. Test Standards

FCC Part 15, Subpart B (10-1-2021 Edition); ANSI C63.4-2014.

1.3. Test Result

Total test 2 items, pass 2 items. Please refer to "6.2 Test Results".

1.4. Testing Location

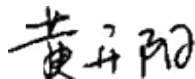
Address: EMC Lab,Building G, Shenzhen International Innovation Center,
No.1006 Shennan Road, Futian District, Shenzhen, Guangdong,
China

1.5. Project data

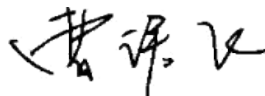
Testing Start Date: 2023-07-18

Testing End Date: 2023-07-19

1.6. Signature



Huang Kaiyang
(Prepared this test report)



Cao Junfei
(Approved this test report)



Huang Yuqing
(Reviewed this test report)



2. CLIENT INFORMATION

2.1. Applicant Information

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2.2. Manufacturer Information

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3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT

(AE)

3.1. About EUT

Description	LINKHUB
Model Name	HH40L2
FCC ID	2ACCJB202
Condition of EUT as received	No obvious damage in appearance

Note: Components list, please refer to documents of the manufacturer; it is also included in the original test record of Shenzhen Academy of Information and Communications Technology.

3.2. Internal Identification of EUT

EUT ID*	SN or IMEI	HW Version	SW Version	Receive Date
UT01aa	354205410002643	TZ7.823.397	HH40L2.1.01	2023-07-16

*EUT ID: is used to identify the test sample in the lab internally.

3.3. Internal Identification of AE

AE ID*	Description
AE1	Adapter

AE1-1

Model	1-CHUSB102-130
Manufacturer	Huizhou Puan electronics Co.,Ltd

AE1-2

Model	1-CHUSB102-131
Manufacturer	Huizhou Puan electronics Co.,Ltd

AE1-3

Model	1-CHUKB102-132
Manufacturer	Huizhou Puan electronics Co.,Ltd

* AE ID: is used to identify the test sample in the lab internally.

AE: ancillary equipment

AE1: The circuit boards of AE1-1, AE1-2 and AE1-3 are the same.

3.4. EUT Set-ups

EUT set-up No.	Combination of EUT and AE	Remarks
Set.1	EUT+AE1-1+PC	

3.5. General Description

The Equipment Under Test (EUT) is a model of LINKHUB with internal antenna.

It supports GSM 900/1800/1900MHz, LTE Bands 5/41.

It has Wi-Fi and Wired network functions.

It consists of normal options: Adapter.

Manual and specifications of the EUT were provided to fulfill the test.

Samples (EUT+AE) undergoing test were selected by the Client. Relevant information is provided by the client.

This report also serves as a record of HH40L2, the table below shows the differences;

Model Differences	HH40L2 (Initial)	HH40L2 (Record)
PCB Layout	HH40L2 (Record) had Remove battery and mainboard charging circuit components	

According to the declaration of differences by manufacturer, the following tests need to be performed.

NO.	Test item	EUT set-ups	Operating mode
1	Conducted Emission	Set.1	LTE receiver
2	Radiated Emission	Set.1	Wired network function

Other results are cited from the initial report.

The report number for initial model is I23N000436-EMC.

4. REFERENCE DOCUMENTS

4.1. Reference Documents for Testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part 15, Subpart B	Radio frequency devices	(10-1-2021 Edition)
ANSI C63.4	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	2014

5. LABORATORY ENVIRONMENT

Anechoic chamber (FACT3-2.0) did not exceed following limits along the EMC testing:

9.10m×6.10m×5.60m (L×W×H)

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB
Electrical insulation	> 2MΩ
Ground system resistance	< 4Ω
Normalised site attenuation (NSA)	< ± 4 dB, 3 m distance, from 30 to 1000 MHz
Voltage Standing Wave Ratio (VSWR)	≤ 6 dB, from 1 to 18 GHz, 3 m distance
Uniformity of field strength	Between 0 and 6 dB, from 80 to 6000 MHz

Shielded room did not exceed following limits along the EMC testing:

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. =20 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB
Electrical insulation	> 2MΩ
Ground system resistance	< 4Ω

6. SUMMARY OF TEST RESULTS

6.1. Testing Environment

Normal Temperature: 15~35℃
Relative Humidity: 20~75%
Atmospheric pressure 86~106kPa

6.2. Summary of Measurement Results

Abbreviations used in this clause:	
P	Pass
NA	Not applicable
F	Fail

Items	Test Name	Clause in FCC/IC rules	Section in this report	Verdict
1	Radiated Emission	15.109(a)/ Section 6.2	A.1	P
2	Conducted Emission	15.107(a)/ Section 6.1	A.2	P

6.3. Statement

6.3.1 Statements of conformity

This report takes measured values as criterion of test conclusion. The test conclusion meets the limit requirements.

7. MEASUREMENT UNCERTAINTY

Test item	Frequency ranges	Measurement uncertainty
Radiated Emission	30MHz-1GHz	4.80dB(k=2)
	1GHz-18GHz	4.62dB(k=2)
Conducted Emission	150kHz-30MHz	2.68dB(k=2)

8. MEASURING APPARATUS UTILIZED

No.	Name	Model	Serial Number	Manufacturer	Calibration Due date	Calibration Period
1.	Test Receiver	ESR7	101676	R&S	2023.11.23	1 year
2.	Test Receiver	ESCI	100702	R&S	2024.01.11	1 year
3.	Spectrum Analyzer	FSV40	101192	R&S	2024.01.11	1 year
4.	BiLog Antenna	3142E	0224831	ETS-Lindgren	2024.05.27	3 years
5.	Horn Antenna	3117	00066577	ETS-Lindgren	2025.04.17	3 years
6.	LISN	ENV216	102067	R&S	2023.09.06	1 year
7.	Anechoic Chamber	FACT3-2.0	1285	ETS-Lindgren	2025.05.28	2 years
8.	Software	EMC32	V10.50.40	R&S	/	/
9.	Universal Radio Communication Tester	CMW500	152499	R&S	2024.07.13	1 year



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9. TEST ACCESSORY UTILIZED

No.	Name	Model	Serial Number	Manufacturer	Calibration Due date	Calibration Period
1.	PC	ThinkPad T480	PF-13LW0C	Lenovo	/	/
2.	Printer	P1008	VNF6C12491	HP	/	/
3.	Mouse	MOEUUOA	44NY517	Lenovo	/	/

ANNEX A: MEASUREMENT RESULTS

A.1 Radiated Emission (§15.109(a))

Reference

FCC: Part 15.109(a)

A.1.1 Method of measurement

The field strength of radiated emissions from the unintentional radiator at a distance of 3 meters or 1 meter is tested. Tested in accordance with the procedures of ANSI C63.4 -2014, section 8.3. The EUT was placed on a non-conductive table. Below 18GHz the measurement antenna was placed at a distance of 3 meters from the EUT. Above 18GHz the measurement antenna was placed at a distance of 1 meters from the EUT. (According to Part 15.31(f)(1), 1m limit is calculated by extrapolation factor of 20 dB/decade) During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

A.1.2 EUT Operating Mode:

Wired network function: A laptop is connected to EUT by unshielded Twisted Pair. The EUT allocate an IP address to this laptop, and start a PING program to establish a communication link between EUT and the laptop.

LTE receiver: The EUT is connected to a adapter for charging. The EUT is synchronized to System Simulator (SS), and able to respond to paging messages and incoming call. An established call has been released.

This device contains the receivers which tune and operate between 30MHz-960MHz in the following bands:LTE Band 5.

The EUT was tested while operating in licensed band receiver mode. All licensed band receivers that tune in the range of 30MHz-960MHz, as listed in Section 3.1, are investigated. Only the worst case emissions are reported.

All equipment is placed on the test table top and arranged in a typical configuration in accordance with ANSI C63.4-2014 and manipulated to obtain worst case emissions. For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report.

A.1.3 Measurement Limit

Limit from Part 15.109(a)

Frequency range (MHz)	Field strength limit ($\mu\text{V/m}$)		
	Quasi-peak	Average	Peak
30-88	100		
88-216	150		
216-960	200		
960-1000	500		
>1000		500	5000

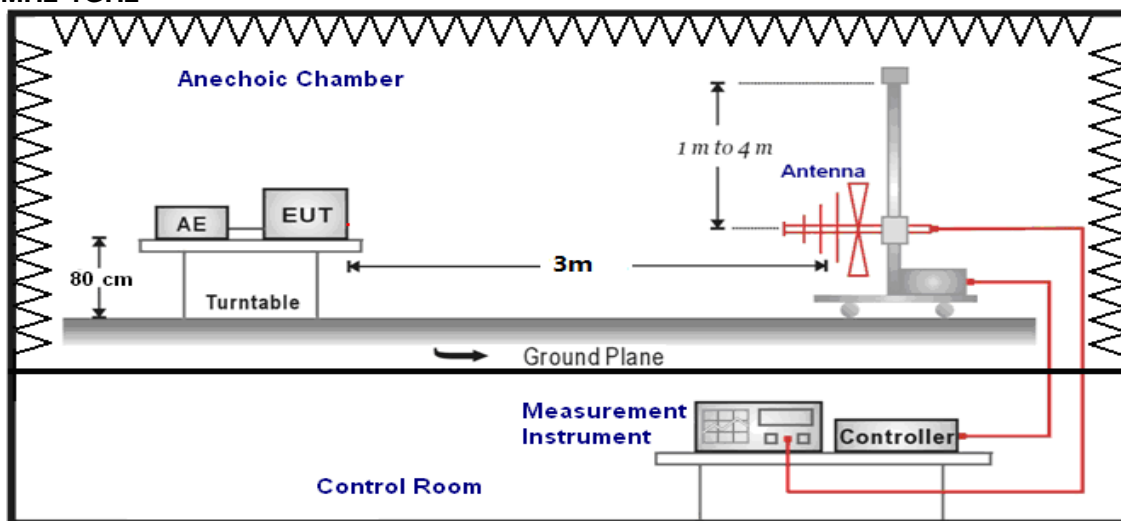
*Note: The original limit is defined at 10m test distance. This limit is calculated according to CISPR requirements.

A.1.4 Test Condition

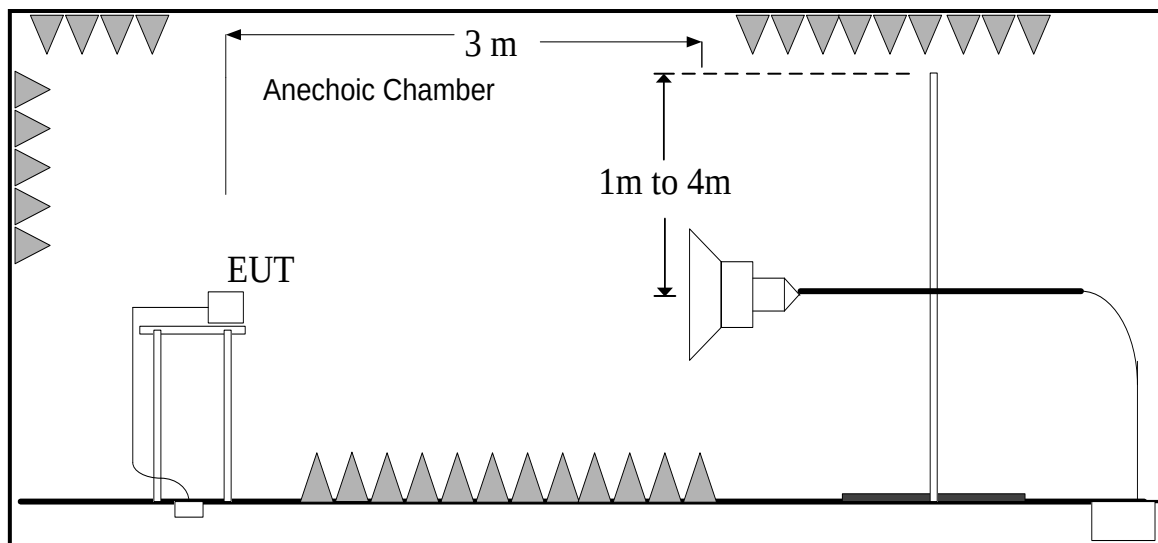
Frequency of emission (MHz)	RBW/VBW	Sweep Time(s)
30-1000	120kHz (IF bandwidth)	5
Above 1000	1MHz/3MHz	15

A.1.5 Test set-up:

30MHz-1GHz



1GHz-40GHz



A.1.6 Measurement Results

A "reference path loss" is established and the A_{Rpl} is the attenuation of "reference path loss". It includes the antenna factor of receive antenna and the path loss.

The measurement results are obtained as described below:

$$\text{Result} = P_{\text{Mea}} + A_{Rpl} = P_{\text{Mea}} + G_A + G_{PL}$$

Where

G_A : Antenna factor of receive antenna

G_{PL} : Path Loss

P_{Mea} : Measurement result on receiver.

Result: Quasi-Peak(dBμV/m) / Average(dBμV/m)/Peak(dBμV/m)

Note: the result contains vertical part and Horizontal part

LTE receiver Band 5

Frequency range (MHz)	Quasi-Peak Limit (dBμV/m)	Result (dBμV/m)	Conclusion
		UT01aa/Set.1	
30-88	40.00	See Figure A.1.1.	P
88-216	43.52		
216-960	46.02		
960-1000	54.00		

Frequency range (MHz)	Average Limit (dBμV/m)	Peak Limit (dBμV/m)	Result (dBμV/m)	Conclusion
			UT01aa/Set.1	
1000 to 18000	54.00	74.00	See Figure A.1.2.	P

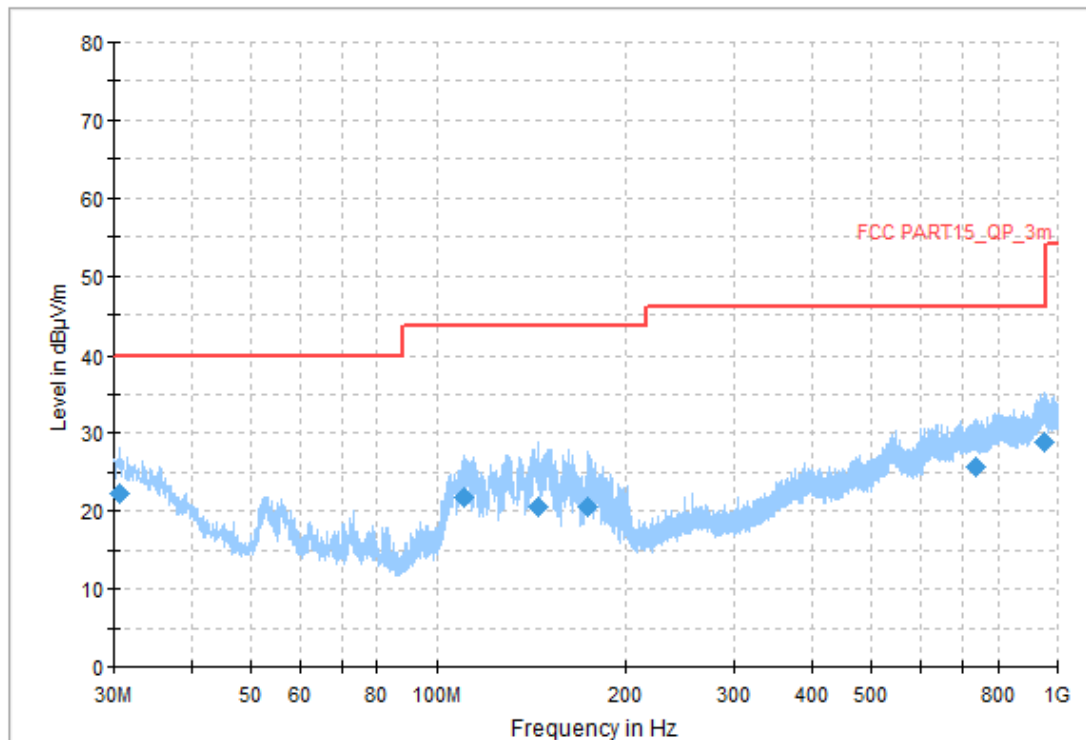


Figure A.1.1. Radiated Emission (LTE receiver Band 5, 30MHz to 1GHz)

Final_Results

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Pol	ARpl (dB/m)	P _{Mea} (dBμV)
30.700556	22.26	40.00	17.74	V	-12	34.26
110.510000	21.74	43.52	21.78	V	-19	40.74
144.513889	20.45	43.52	23.07	V	-18	38.45
173.937222	20.44	43.52	23.08	V	-17	37.44
736.645000	25.67	46.02	20.35	V	-1	26.67
951.607778	28.77	46.02	17.25	V	3	25.77

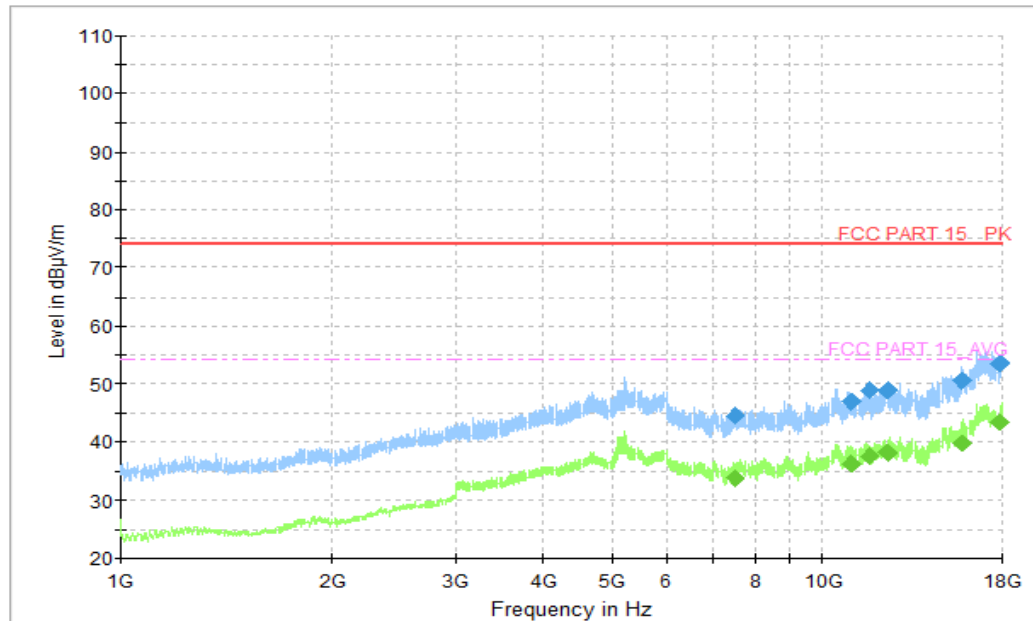


Figure A.1.2. Radiated Emission (LTE receiver Band 5, 1GHz to 18GHz)

Final_Results_PK

Frequency(MHz)	Peak (dBμV/m)	Limit (dBμV/m)	Margin(dB)	Polarity	ARpl (dB/m)	PMea (dBμV)
7506.923077	44.49	74.00	29.71	H	5.7	38.79
10965.230769	46.86	74.00	27.24	V	9.6	37.26
11646.000000	48.98	74.00	25.22	H	9.9	39.08
12394.153846	48.96	74.00	25.24	H	11.3	37.66
15807.692308	50.67	74.00	23.53	H	14.0	36.67
17906.307692	53.45	74.00	20.75	V	18.8	34.65

Final_Results_AVG

Frequency(MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin(dB)	Polarity	ARpl (dB/m)	P _{Mea} (dBμV)
7506.923077	33.75	54.00	20.45	H	5.7	28.05
10965.230769	36.27	54.00	17.93	V	9.6	26.67
11646.000000	37.49	54.00	16.71	H	9.9	27.59
12394.153846	38.05	54.00	16.15	H	11.3	26.75
15807.692308	39.89	54.00	14.31	H	14.0	25.89
17906.307692	43.47	54.00	10.73	V	18.8	24.67

A.2 Conducted Emission (§15.107(a))**Reference**

FCC: Part 15.107(a)

A.2.1 Method of measurement

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz shall not exceed the limits. Tested in accordance with the procedures of ANSI C63.4 -2014, section 7.3.

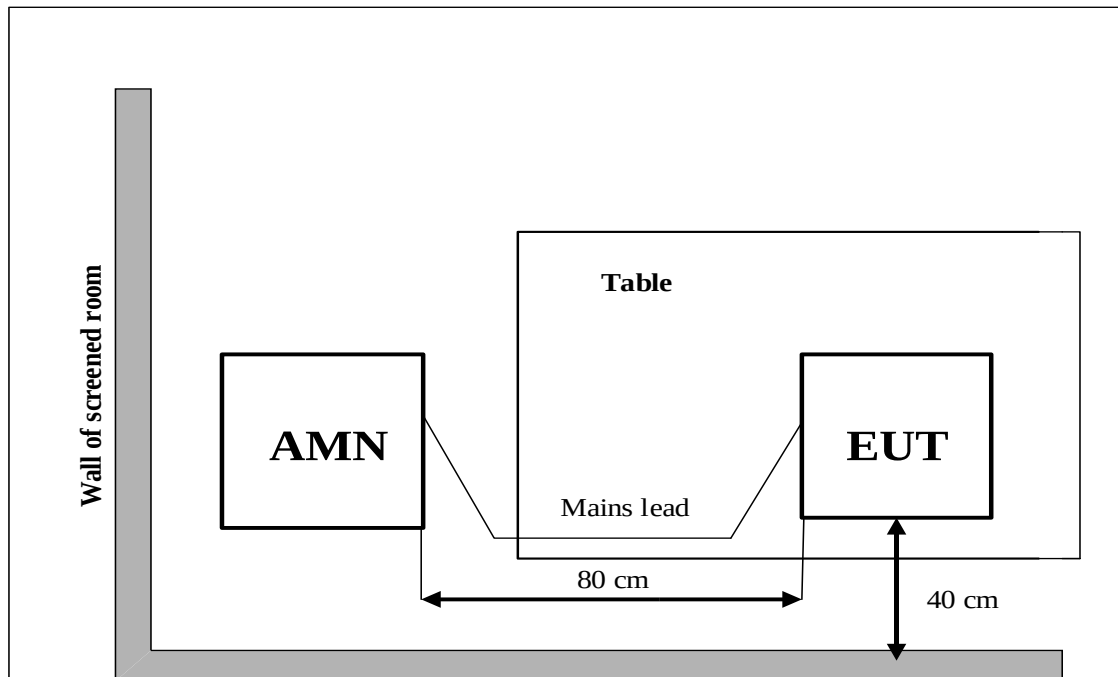
A.2.2 EUT Operating Mode:

Wired network function: A laptop is connected to EUT by unshielded Twisted Pair. The EUT allocate an IP address to this laptop, and start a PING program to establish a communication link between EUT and the laptop.

A.2.3 Measurement Limit

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
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		

A.2.4 Test set-up:



A.2.5 Test Condition in charging mode

Voltage (V)	Frequency (Hz)
120	60
240	60

RBW	Sweep Time(s)
9kHz	1

A.2.6 Measurement Results

QuasiPeak(dBμV) /Average(dBμV) =PMea+Corr

Where

Corr: PathLoss + Voltage Division Factor

PMea: Measurement result on receiver.

Wired network function

AC Input Port/ Voltage: 120V/60Hz

Frequency range (MHz)	Quasi-peak Limit (dBμV)	Average Limit (dBμV)	Result (dBμV)	Conclusion
			UT01aa/Set.1	
0.15 to 0.5	66 to 56	56 to 46	See Figure A.2.1.	P
0.5 to 5	56	46		
5 to 30	60	50		

NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

AC Input Port/ Voltage: 120V/60Hz

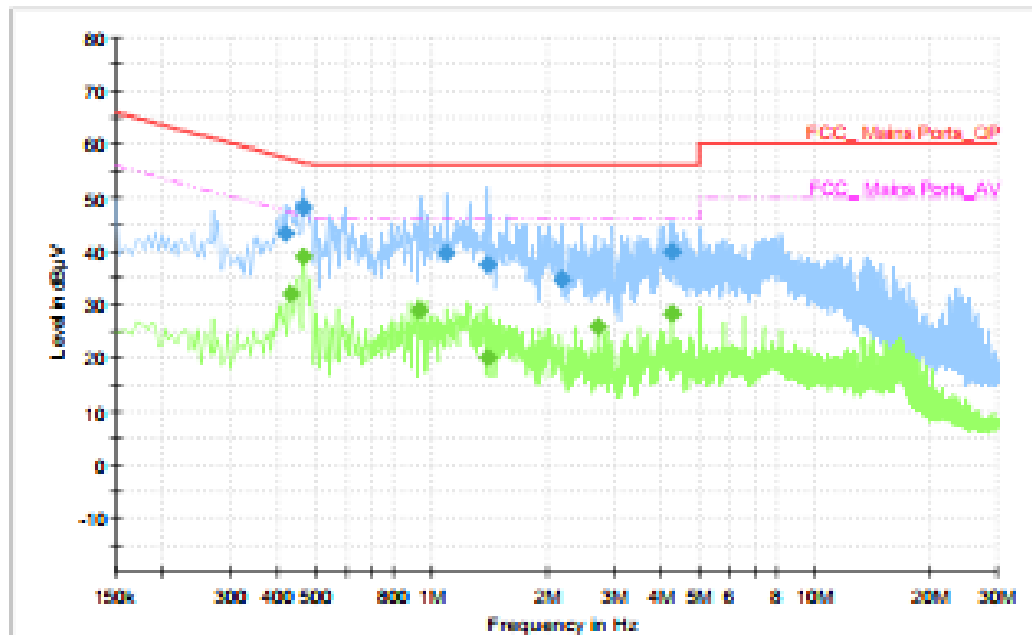


Figure A.2.1. Conducted Emission (Wired network function)

Final_Result_QPK

Frequency (MHz)	QuasiPeak (dBμV)	Limit (dBμV)	Margin (dB)	Line	Corr. (dB)	P _{Mea} (dBμV)
0.414000	43.33	57.57	14.24	L1	10	33.33
0.466000	48.27	56.59	8.32	L1	10	38.27
1.094000	39.66	56.00	16.34	N	10	29.66
1.406000	37.58	56.00	18.42	N	10	27.58
2.186000	34.77	56.00	21.23	L1	10	24.77
4.258000	39.97	56.00	16.03	N	10	29.97

Final_Result_AVG

Frequency (MHz)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Line	Corr. (dB)	P _{Mea} (dBμV)
0.430000	31.96	47.25	15.29	L1	10	21.96
0.466000	39.02	46.59	7.56	L1	10	29.02
0.930000	28.95	46.00	17.05	N	10	18.95
1.406000	19.98	46.00	26.02	N	10	9.98
2.710000	25.98	46.00	20.02	N	10	15.98
4.258000	28.42	46.00	17.58	N	10	18.42

****END OF REPORT****