

TEST REPORT

EMI Test for FCC Certification of LM-X320AA

APPLICANT

LG Electronics USA, Inc.

REPORT NO.

HCT-EM-1906-FC005

DATE OF ISSUE

June 04, 2019

HCT Co., Ltd.

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FCC ID.

ZNFX320AA

Applicant LG Electronics USA, Inc.
1000 Sylvan Avenue, Englewood Cliffs NJ 07632 United States

Product Name Multi-band GSM/EDGE/WCDMA/LTE Phone with WLAN, Bluetooth and NFC
Model Name LM-X320AA
Series Model Name Refer to the clause 1.1 Description of EUT

Date of Test May 20, 2019 to May 28, 2019

Test Standard Used FCC CFR 47 PART 15 Subpart B Class B
ANSI C63.4-2014

Test Results Refer to the present document

Manufacturer LG Electronics Inc.

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.

Tested by
Na-Eun Song

(signature)

Technical Manager
Jeong-Hyun Choi

(signature)

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	June 04, 2019	Initial Release

The device bearing the trade name and model specified above, has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2014. (See Test Report if any modifications were made for compliance)

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

HCT certifies that no party to application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C 862

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1. GENERAL INFORMATION

1.1 Description of EUT

Its basic purpose is used for communications.

FCC ID	ZNFX320AA
Model	LM-X320AA
Series Model Name	LMX320AA, X320AA
EUT Type	Multi-band GSM/EDGE/WCDMA/LTE Phone with WLAN, Bluetooth and NFC
TX Frequency	824.20 MHz to 848.80 MHz (GSM 850) 1 850.20 MHz to 1 909.80 MHz (GSM 1 900) 1 852.4 MHz to 1 907.6 MHz (WCDMA B2) 1712.4 MHz to 1752.6 MHz (WCDMA B4) 826.40 MHz to 846.60 MHz (WCDMA B5) 1 850 MHz to 1 910 MHz (LTE B2) 1 710 MHz to 1 755 MHz (LTE B4) 824 MHz to 849 MHz (LTE B5) 699 MHz to 716 MHz (LTE B12) 788 MHz to 798 MHz (LTE B14) 2 402 MHz to 2 480 MHz (Bluetooth) 2 412 MHz to 2 462 MHz (WiFi 2.4 GHz) 13.56 MHz (NFC)
RX Frequency	869.20 MHz to 893.80 MHz (GSM 850) 1 930.20 MHz to 1 989.80 MHz (GSM 1 900) 1 932.4 MHz to 1 987.6 MHz (WCDMA B2) 2 112.4 MHz to 2 152.6 MHz (WCDMA B4) 871.40 MHz to 891.60 MHz (WCDMA B5) 1 930 MHz to 1 990 MHz (LTE B2) 2 110 MHz to 2 155 MHz (LTE B4) 869 MHz to 894 MHz (LTE B5) 729 MHz to 746 MHz (LTE B12) 758 MHz to 768 MHz (LTE B14) 2 402 MHz to 2 480 MHz (Bluetooth) 2 412 MHz to 2 462 MHz (WiFi 2.4 GHz) 13.56 MHz (NFC)

1.2 Tested System Details

All equipment descriptions used in the tested system (including inserted cards) are:

Device Type	Model Name	Serial Number	Manufacturer
EUT	LM-X320AA	-	LG
Data cable ^(*)	EAD62377921	-	Leagtech
Data cable ^(*)	EAD62377922	-	KSD
Data cable ^(*)	EAD62377927	-	NINGBO
Earphone	EAB64468444	-	CRESYN
Notebook PC	ProBook6560b	5CB2053MXF	HP
Notebook PC adaptor	Series PPP009L-E	-	LITE-ON Technology
Gateway	TL-WR747N	-	TP Link
Gateway adaptor	T090060-2H1	-	TP Link
Serial mouse	Serial 2 Button mouse	02031069	Radio Shack
RJ45 cable	-	-	-
Micro SD card	Extreme Micro SDHC UHS-1 CLASS 10 (32 GB)	-	SanDisk

(*) The worst-cable emissions are reported.

1.3 Cable Description

Product Name	Port	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (m)
EUT	Micro USB	Y	Y	(P,D) 1.0
	Earphone	N/A	N	(D) 1.2
Notebook PC	RJ 45	N/A	N	(D) 1.6
	Serial(Mouse)	N/A	Y	(D) 1.8
	DC IN	N	N/A	(P) 1.8
Gateway	DC IN	N	N/A	(P) 1.8

NOTE. The marked "(D)" means the data cable and "(P)" means the power cable.

1.4 Noise Suppression Parts on Cable (I/O Cable)

Product Name	Port	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
EUT	Micro USB	N	N/A	Y	Both End
	Earphone	N	N/A	Y	EUT End
Notebook PC	RJ 45	N	N/A	N	N/A
	Serial(Mouse)	N	N/A	Y	Notebook PC End

1.5 Test Facility

Test site is located at 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, South Korea. Those measurement facilities are constructed in conformance with the requirements of ANSI C63.4-2014. The Normalized site attenuations (30 MHz to 1 GHz) and Site validation (1 GHz to 18 GHz) were performed in accordance with the standard in ANSI C63.4-2014

Measurement Facilities	Designation No.
Radiated Field strength measurement facility 3 m Semi Anechoic chamber	KR0032
Radiated Field strength measurement facility 10 m Semi Anechoic chamber #1	
Radiated Field strength measurement facility 10 m Semi Anechoic chamber #2	

1.6 Calibration of Measuring Instrument

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturers recommendations for utilizing calibration equipment, which is traceable to recognized national standards. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2006).

1.7 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty
Conducted Emission (0.15 MHz to 30 MHz)	1.82 dB
Radiated Emissions (30 MHz to 1 GHz)	5.20 dB
Radiated Emissions (1 GHz to 18 GHz)	5.24 dB
Radiated Emissions (18 GHz to 40 GHz)	5.40 dB

2. DESCRIPTION OF TEST

2.1 Measurement of Conducted Emission

The test procedure was in accordance with ANSI C63.4-2014, Clause 7.3

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN).
If the EUT is connected to the PC through USB, the AC power-line adapter of the PC is directly connected to a line impedance stabilization network (LISN).
Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both conducted lines are measured in Quasi-Peak and Average mode, including the worst-case data points for each tested configuration.
- c. The frequency range from 150 kHz to 30 MHz was searched.

Conducted Emission Limits

Frequency (MHz)	Resolution Bandwidth (kHz)	Class A		Class B	
		Quasi-Peak (dBμV)	Average (dBμV)	Quasi-Peak (dBμV)	Average (dBμV)
0.15 to 0.5	9	79	66	66 to 56*	56 to 46*
0.5 to 5	9	73	60	56	46
5 to 30	9	73	60	60	50

NOTE. Decreases with the logarithm of the frequency.

2.2 Measurement of Radiated Emission

The test procedure was in accordance with ANSI C63.4-2014, Clause 8.3

- The EUT was placed on the top of a turn table 0.8 meters above the ground at a semi-anechoic chamber.
The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from 1 m to 4 m 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.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 m to 4 m and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.
- 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.
- 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.
- Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response.
(1 GHz to 40 GHz)

Radiated Emission Limits

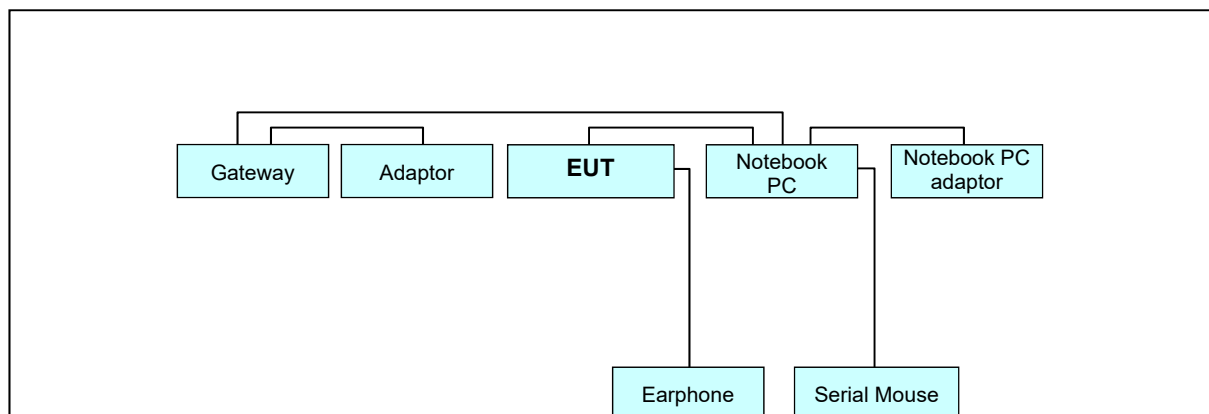
Frequency (MHz)	Class A			Class B		
	Antenna Distance (m)	Field Strength (μV/m)	Quasi-Peak (dBμV/m)	Antenna Distance (m)	Field Strength (μV/m)	Quasi-Peak (dBμV/m)
30 to 88	10	90	39.0	3	100	40.0
88 to 216	10	150	43.5	3	150	43.5
216 to 960	10	210	46.4	3	200	46.0
Above 960	10	300	49.5	3	500	54.0
Frequency (MHz)	Antenna Distance (m)	Class A		Class B		
		Peak (dBμV/m)	Average (dBμV/m)	Peak (dBμV/m)	Average (dBμV/m)	
Above 1 000	3	80	60	74	54	

2.2.1 Frequency Range of Radiated Measurements

An unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a Radiated Emission limit is specified, up to the frequency shown in the following table

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 to 108	1 000
108 to 500	2 000
500 to 1 000	5 000
Above 1 000	5th harmonic of the highest frequency or 40 GHz, whichever is lower
Below 1.705	30

2.3 Configuration of Tested System



Non-Conductive Table

Power Line: 120 VAC, 60 Hz

3. PRELIMINARY TEST

3.1 Conducted Emission

It was tested the following operating mode, after connecting all peripheral devices.

Operating Modes: Data Communication mode

3.2 Radiated Emission

It was tested the following operating mode, after connecting all peripheral devices.

Operating Modes: Data Communication mode

4. CONDUCTED EMISSION AND RADIATED EMISSION TEST SUMMARY

4.1 Conducted Emission

4.1.1 Measuring instruments

	Type	Manufacturer	Model Name	Serial Number	Calibration Cycle	Calibration Date
☒	EMI Test Receiver	Rohde & Schwarz	ESCI	100584	1 year	06.25.2018
☒	LISN	Rohde & Schwarz	ENV216	102245	1 year	12.12.2018
☒	LISN	Rohde & Schwarz	ENV216	100073	1 year	04.30.2019
☒	Software	Rohde & Schwarz	EMC32 VER8.54.0	-	-	-

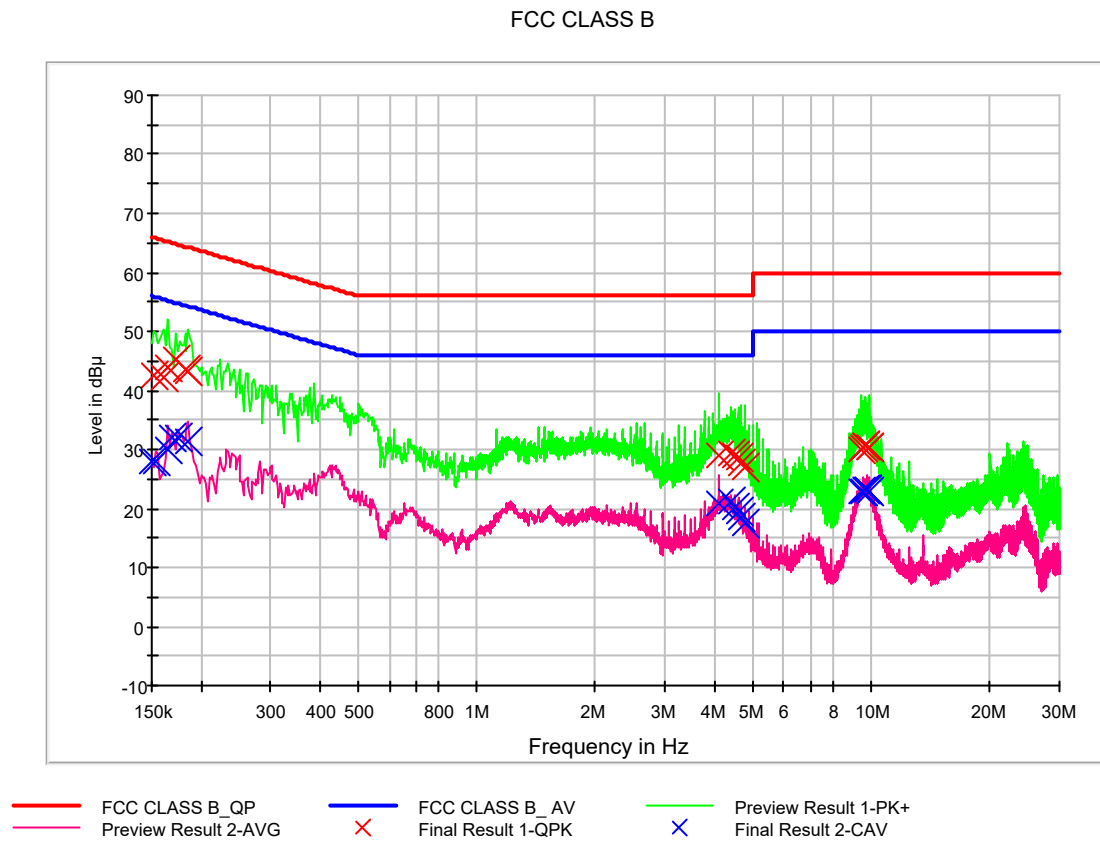
4.1.2 Operating Condition

The test results of conducted emission at mains ports provide the following information:

Test Standard Used	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Detector	Quasi-Peak, CISPR-Average
Bandwidth	9 kHz (6 dB)
Operating Mode	Data Communication mode
Worst Data Cable	Leagtech (EAD62377921)
Kind of Test Site	Shielded Room
Temperature	24.3 °C
Relative Humidity	44.6 %
Test Date	May 28, 2019

4.1.3 Measuring Data

Figure 1: Conducted Emission, AC Main Port, Line (L1)



QuasiPeak Final Result, Line (L1)

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.152000	42.7	9.000	L1	9.6	23.2	65.9
0.160000	42.2	9.000	L1	9.6	23.3	65.5
0.164000	43.8	9.000	L1	9.6	21.5	65.3
0.172000	45.2	9.000	L1	9.6	19.7	64.9
0.182000	43.7	9.000	L1	9.6	20.7	64.4
0.186000	43.1	9.000	L1	9.7	21.1	64.2
4.088000	28.8	9.000	L1	9.8	27.2	56.0
4.390000	29.4	9.000	L1	9.8	26.6	56.0
4.492000	29.0	9.000	L1	9.8	27.0	56.0
4.592000	28.7	9.000	L1	9.8	27.3	56.0
4.696000	27.7	9.000	L1	9.8	28.3	56.0
4.782000	27.0	9.000	L1	9.8	29.0	56.0
9.422000	30.0	9.000	L1	10.0	30.0	60.0
9.524000	30.4	9.000	L1	10.0	29.6	60.0
9.622000	30.6	9.000	L1	10.0	29.4	60.0
9.626000	30.5	9.000	L1	10.0	29.5	60.0
9.828000	30.4	9.000	L1	10.0	29.6	60.0
9.832000	30.4	9.000	L1	10.0	29.6	60.0

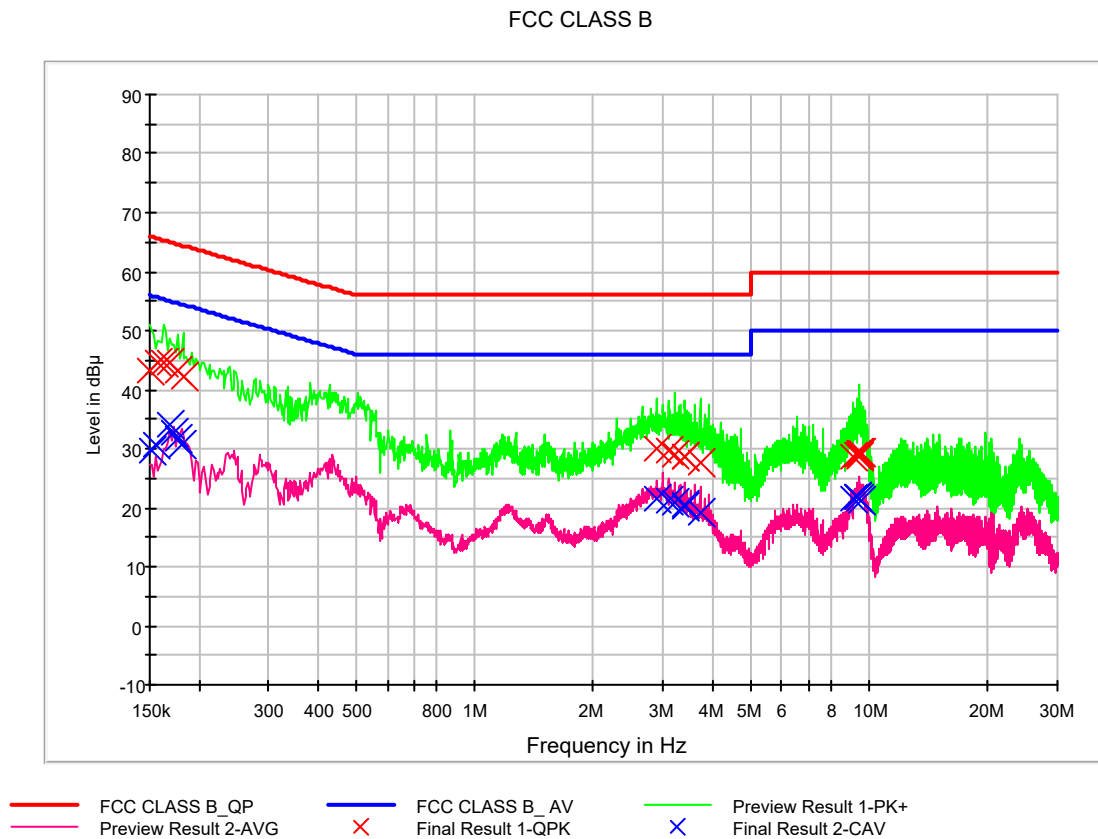
Calculation Formula:

1. Conductor L1 = Hot, Conductor N = Neutral
2. Corr. = LISN Factor + Cable Loss
3. QuasiPeak or CAverage= Receiver Reading + Corr.
4. Margin = Limit – QuasiPeak or CAverage

CAverage Final Result, Line (L1)

Frequency (MHz)	CAverage (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	28.1	9.000	L1	9.6	27.9	56.0
0.154000	27.8	9.000	L1	9.6	27.9	55.8
0.164000	30.1	9.000	L1	9.6	25.2	55.3
0.168000	32.0	9.000	L1	9.6	23.1	55.1
0.174000	32.2	9.000	L1	9.6	22.6	54.8
0.186000	31.2	9.000	L1	9.7	23.0	54.2
4.088000	20.9	9.000	L1	9.8	25.1	46.0
4.390000	21.0	9.000	L1	9.8	25.0	46.0
4.492000	20.0	9.000	L1	9.8	26.0	46.0
4.592000	19.5	9.000	L1	9.8	26.5	46.0
4.696000	18.4	9.000	L1	9.8	27.6	46.0
4.782000	17.5	9.000	L1	9.8	28.5	46.0
9.422000	22.8	9.000	L1	10.0	27.2	50.0
9.524000	23.0	9.000	L1	10.0	27.0	50.0
9.626000	23.3	9.000	L1	10.0	26.7	50.0
9.730000	23.3	9.000	L1	10.0	26.7	50.0
9.734000	23.2	9.000	L1	10.0	26.8	50.0
9.830000	22.9	9.000	L1	10.0	27.1	50.0

Figure 2: Conducted Emission, AC Main Port, Line (N)



QuasiPeak Final Result, Line (N)

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	43.2	9.000	N	9.6	22.8	66.0
0.158000	44.5	9.000	N	9.6	21.0	65.6
0.162000	44.6	9.000	N	9.6	20.7	65.4
0.168000	44.5	9.000	N	9.6	20.5	65.1
0.176000	43.1	9.000	N	9.6	21.6	64.7
0.182000	42.2	9.000	N	9.6	22.2	64.4
2.904000	29.9	9.000	N	9.8	26.1	56.0
3.106000	29.5	9.000	N	9.8	26.5	56.0
3.206000	29.0	9.000	N	9.8	27.0	56.0
3.412000	28.7	9.000	N	9.8	27.3	56.0
3.416000	28.6	9.000	N	9.8	27.4	56.0
3.720000	27.5	9.000	N	9.8	28.5	56.0
9.150000	28.8	9.000	N	9.9	31.2	60.0
9.358000	29.1	9.000	N	9.9	30.9	60.0
9.436000	28.8	9.000	N	9.9	31.2	60.0
9.440000	28.9	9.000	N	9.9	31.1	60.0
9.460000	29.2	9.000	N	9.9	30.8	60.0
9.564000	29.2	9.000	N	9.9	30.8	60.0

CAverage Final Result, Line (N)

Frequency (MHz)	CAverage (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.152000	29.6	9.000	N	9.6	26.3	55.9
0.156000	30.6	9.000	N	9.6	25.0	55.7
0.168000	33.9	9.000	N	9.6	21.1	55.1
0.172000	32.8	9.000	N	9.6	22.1	54.9
0.176000	31.5	9.000	N	9.6	23.1	54.7
0.180000	30.7	9.000	N	9.6	23.8	54.5
2.904000	21.6	9.000	N	9.8	24.4	46.0
3.106000	21.1	9.000	N	9.8	24.9	46.0
3.208000	20.8	9.000	N	9.8	25.2	46.0
3.412000	20.3	9.000	N	9.8	25.7	46.0
3.416000	20.2	9.000	N	9.8	25.8	46.0
3.720000	19.1	9.000	N	9.8	26.9	46.0
9.138000	21.4	9.000	N	9.9	28.6	50.0
9.292000	21.8	9.000	N	9.9	28.2	50.0
9.324000	22.0	9.000	N	9.9	28.0	50.0
9.356000	21.8	9.000	N	9.9	28.2	50.0
9.460000	21.4	9.000	N	9.9	28.6	50.0
9.564000	21.4	9.000	N	9.9	28.6	50.0

4.2 Radiated Emission Below 1 GHz

4.2.1 Measuring instruments

	Type	Manufacturer	Model Name	Serial Number	Calibration Cycle	Calibration Date
☒	EMI test receiver	Rohde & Schwarz	ESU40	100524	1 year	05.17.2019
☒	Trilog antenna	Schwarzbeck	VULB 9168	255	2 year	03.26.2019
☒	Antenna master	INNCO Systems	MA4640-XP-ET	-	N/A	-
☒	Antenna master controller	INNCO Systems	CO3000	CO3000/870/ 35990515/L	N/A	-
☒	Turn Table	INNCO Systems	1060	-	N/A	-
☒	Turn table controller	INNCO Systems	CO2000	CO2000/095/ 7590304/L	N/A	-
☒	Software	Rohde & Schwarz	EMC32 VER8.40.0	-	-	-

4.2.2 Operating Condition

The test results of radiated emission provide the following information:

Used Test Standard	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Detector	Quasi-Peak
Bandwidth	120 kHz (6 dB)
Operating Mode	Data Communication mode
Worst Data Cable	Leagtech (EAD62377921)
Kind of Test Site	3 m semi anechoic chamber
Temperature	22.5 °C
Relative Humidity	44.6 %
Test Date	May 20, 2019

4.2.3 Measuring Data

Frequency (MHz)	Quasi Peak (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
30.767232	25.8	100.0	V	102.0	18.4	14.2	40.0
86.598400	21.7	275.0	H	116.0	14.8	18.3	40.0
136.368000	23.9	100.0	V	320.0	18.7	19.6	43.5
265.581600	32.4	116.7	H	310.0	19.3	13.6	46.0
600.004000	40.6	299.7	V	72.0	27.4	5.4	46.0
800.036000	39.8	100.0	H	231.0	30.4	6.2	46.0

- Calculation Formula:

1. POL. H = Horizontal, POL. V = Vertical
2. QuasiPeak = Reading (Receiver Reading) + Corr.
3. Corr. (Correction Factor) = Antenna Factor + Cable Loss
4. Margin = Limit - QuasiPeak

4.3 Radiated Emission Above 1 GHz

4.3.1 Measuring instruments

	Type	Manufacturer	Model Name	Serial Number	Calibration Cycle	Calibration Date
☒	EMI test receiver	Rohde & Schwarz	ESU40	100524	1 year	05.17.2019
☒	Antenna master	INNCO Systems	MA4640-XP-ET	-	N/A	-
☒	Antenna master controller	INNCO Systems	CO3000	CO3000/870/ 35990515/L	N/A	-
☒	Turn table	INNCO Systems	1060	-	N/A	-
☒	Turn table controller	INNCO Systems	CO2000	CO2000/095/ 7590304/L	N/A	-
☒	Horn antenna	Schwarzbeck	BBHA 9120D	01836	2 year	07.20.2018
☒	Low Noise amplifier	TESTEK	TK-PA18H	170034-L	1 year	03.04.2019
☒	Software	Rohde & Schwarz	EMC32 VER8.40.0	-	-	-

4.3.2 Operating Condition

The test results of radiated emission provide the following information:

Used Test Standard	FCC CFR 47 PART 15 Subpart B Class B ANSI C63.4-2014
Detector	Peak mode: Peak (RBW: 1 MHz, VBW: 3 MHz) CISPR-Average mode: Peak (RBW: 1 MHz, VBW: 10 Hz)
Highest Frequency	2 480 MHz
Tested Frequency Range	1 GHz to 18 GHz
Operation Mode	Data Communication mode
Worst Data Cable	Leagtech (EAD62377921)
Kind of Test Site	3 m semi anechoic chamber
Temperature	24.2 °C
Relative Humidity	43.9 %
Test Date	May 24, 2019

This report only responds to the tested sample and may not be reproduced, except in full, without written approval of the HCT Co., Ltd.

4.3.3 Measuring Data

Frequency (MHz)	Peak (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1399.995000	50.6	219.5	V	37.0	-26.0	23.4	74.0
1994.570000	51.8	100.0	V	232.0	-25.2	22.2	74.0
2660.835000	50.4	249.6	V	204.0	-22.6	23.6	74.0
4480.940000	45.4	203.4	V	181.0	-17.5	28.6	74.0
5990.315000	47.3	100.0	V	288.0	-14.7	26.7	74.0
10283.770000	48.1	138.7	H	102.0	-4.1	25.9	74.0

Frequency (MHz)	CAverage (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1399.995000	49.4	219.5	V	37.0	-26.0	4.6	54.0
1994.570000	27.1	100.0	V	232.0	-25.2	26.9	54.0
2660.835000	23.7	249.6	V	204.0	-22.6	30.3	54.0
4480.940000	28.8	203.4	V	181.0	-17.5	25.2	54.0
5990.315000	29.8	100.0	V	288.0	-14.7	24.2	54.0
10283.770000	35.3	138.7	H	102.0	-4.1	18.7	54.0

- Calculation Formula:

1. POL. H = Horizontal, POL. V = Vertical
2. Peak or CAverage = Reading (Receiver Reading) + Corr.
3. Corr. (Correction Factor) = Antenna Factor+ Cable Loss –Amplifier Gain
4. Margin = Limit - Peak or CAverage

5. CONCLUSION

The data collected shows that the **EUT Type: Multi-band GSM/EDGE/WCDMA/LTE Phone with WLAN, Bluetooth and NFC, Model: LM-X320AA** complies with §15.107 and §15.109 of the FCC rules.

6. APPENDIX A. TEST SETUP PHOTO

Please refer to Appendix. A and test setup photo file no. as follows;

File No.	Date of Issue	Description
HCT-EM-1906-FC005-P	June 04, 2019	Initial Release

End of report