

EMI TEST REPORT

FCC CERTIFICATION

Applicant:

LG Electronics MobileComm U.S.A., Inc.
1000 Sylvan Avenue, Englewood Cliffs NJ 07632

Date of Receipt: March 02, 2017**Date of Issue: March 10, 2017****Test Report No. HCT-E-1703-F007****HCT FRN: 0005866421****FCC ID :****ZNFVN220****Rule Part(s) / Standard(s):** FCC CFR 47 PART 15 Subpart B Class B**FCC Classification:** JBP (Part 15 B – Class B Computing Device Peripheral)**EUT Type:** Multi-band GSM/WCDMA/LTE Phone with BT and WLAN**Model Name:** LG-VN220**Additional Model Name:** LGVN220, VN220**Date of Test:** March 08, 2017 - March 09, 2017

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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DOCUMENT HISTORY

The revision history for this document is shown in table.

Version	Date	Description
HCT-E-1703-F007	March 10, 2017	Initial Release



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ATTACHMENT: TEST SETUP PHOTOGRAPHS



1. GENERAL INFORMATION

1.1 Description of EUT

Its basic purpose is used for communications.

FCC ID	ZNFVN220
Model	LG-VN220
Additional Model	LGVN220, VN220
EUT Type	Multi-band GSM/WCDMA/LTE Phone with BT and WLAN
TX Frequency	824.20 MHz to 848.80 MHz (GSM 850) 1 850.20 MHz to 1 909.80 MHz (GSM 1 900) 826.40 MHz to 846.60 MHz (WCDMA B5) 1 852.4 MHz to 1 907.6 MHz (WCDMA B2) 1 710 MHz to 1 755 MHz (LTE B4) 824 MHz to 849 MHz (LTE B5) 777 MHz to 787 MHz (LTE B13) 2 402 MHz to 2 480 MHz (Bluetooth) 2 412 MHz to 2 462 MHz (WiFi 2.4 GHz)
RX Frequency	869.2 MHz to 893.8 MHz (GSM 850) 1 930.2 MHz to 1 989.8 MHz (GSM 1 900) 871.4 MHz to 891.6 MHz (WCDMA B5) 1 932.4 MHz to 1 987.6 MHz (WCDMA B2) 2 110 MHz to 2 155 MHz (LTE B4) 869 MHz to 894 MHz (LTE B5) 746 MHz to 756 MHz (LTE B13) 2 402 MHz to 2 480 MHz (Bluetooth) 2 412 MHz to 2 462 MHz (WiFi 2.4 GHz)



1.2 Related Submittal(s) / Grant(s)

Original submittal only.

1.3 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.

Measurement Facilities	Registration Number
Radiated Field strength measurement facility (3 m)	90661 (July 07, 2015)
Radiated Field strength measurement facility (10 m)	

1.4 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 equipments, which is traceable to recognized national standards.

Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2006).



1.5 Tested System Details

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

Device Type	Model Name	Manufacturer	FCC ID / DoC	Connected To
EUT	LG-VN220	LG	ZNFVN220	Notebook PC, Earphone
USB Cable	EAD62377924	KSD	-	EUT, Notebook PC
Earphone	GB170	I-Sound	-	EUT
Notebook PC	ProBook6560b	HP	DoC	Gateway , Notebook PC adaptor, RJ45 cable, Serial mouse
Notebook PC adaptor	Series PPP009L-E	LITE-On Technology	-	Notebook PC
Gateway	TL-WR747N	TP-LINK	-	RJ45 cable, Gateway adaptor
Gateway adaptor	T120150-2H1	TP-LINK	-	Gateway
Serial mouse	Serial 2 button mouse	Radio shack	FSUGMZE3	Notebook PC
RJ45 cable	-	-	-	Notebook PC, Gateway
Micro SD card	MicroSDHC 32 GB	SANDISK	-	EUT



1.6 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	Y	(D)1.1
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

* The marked “(D)” means the data cable and “(P)” means the power cable.

1.7 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	Both End
Notebook PC	RJ 45	N	N/A	N	N/A
	Serial (Mouse)	N	N/A	Y	Notebook PC End



2. 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 (dB)
Conducted Emission (0.158 MHz to 30 MHz)	$\pm 1.82 \text{ dB } (k = 2)$
Radiated Emissions (30 MHz to 1 GHz)	$\pm 5.06 \text{ dB } (k = 2)$
Radiated Emissions (1 GHz to 6 GHz)	$\pm 5.0 \text{ dB } (k = 2)$
Radiated Emissions (6 GHz to 18 GHz)	$\pm 5.4 \text{ dB } (k = 2)$



3. DESCRIPTION OF TEST

3.1 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)	Quasi-Peak (dB(μV))	Average (dB(μV))
0.15 to 0.5	9	66 to 56*	56 to 46*
0.5 to 5	9	56	46
5 to 30	9	60	50

**Decreases with the logarithm of the frequency.*



3.2 Measurement of Radiated Emission

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

- a. 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.
- b. The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. 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.
- d. 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.
- 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.
- g. 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)	Antenna Distance (m)	Field Strength ($\mu\text{V}/\text{m}$)	Quasi-Peak ($\text{dB}(\mu\text{V})/\text{m}$)
30 to 88	3	100	40.0
88 to 216	3	150	43.5
216 to 960	3	200	46.0
Above 960	3	500	54.0
Frequency (MHz)	Antenna Distance (m)	Peak ($\text{dB}(\mu\text{V})/\text{m}$)	Average ($\text{dB}(\mu\text{V})/\text{m}$)
Above 1 000	3	74	54

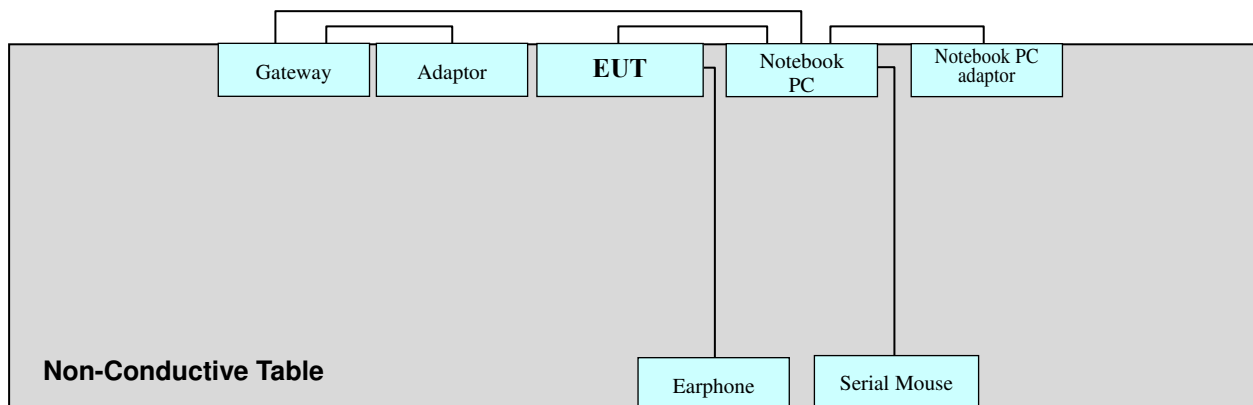


3.2.1 Frequency Range of Radiated Measurements

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	5 th harmonic of the highest frequency or 40 GHz, whichever is lower

3.3 Configuration of Tested System



Power Line: 120 VAC, 60 Hz



4. PRELIMINARY TEST

4.1 Conducted Emission Test

It was tested Data Communication mode, after connecting all peripheral devices.

Operation Mode: ☒ Data Communication mode

4. 2 Radiated Emission Test

It was tested Data Communication mode, after connecting all peripheral devices.

Operation Mode: ☒ Data Communication mode



5. CONDUCTED AND RADIATED EMISSION TEST SUMMARY

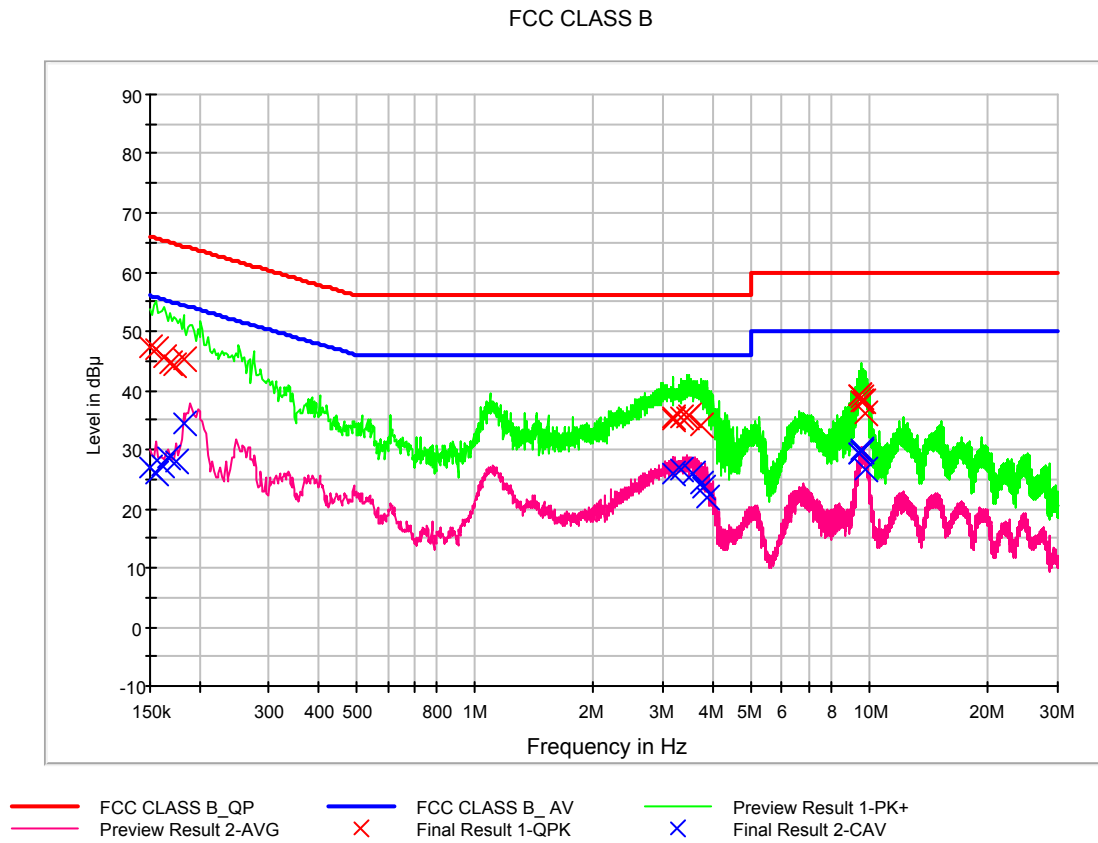
5.1 Conducted Emission Test

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

Rule Part / Standard	FCC PART 15 Subpart B Class B
Detector	Quasi-Peak, CISPR-Average
Bandwidth	9 kHz (6 dB)
Operation Mode	Data Communication mode
Kind of Test Site	Shielded Room
Temperature	23.7 °C
Relative Humidity	37.5 %
Test Date	March 08, 2017

- 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

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



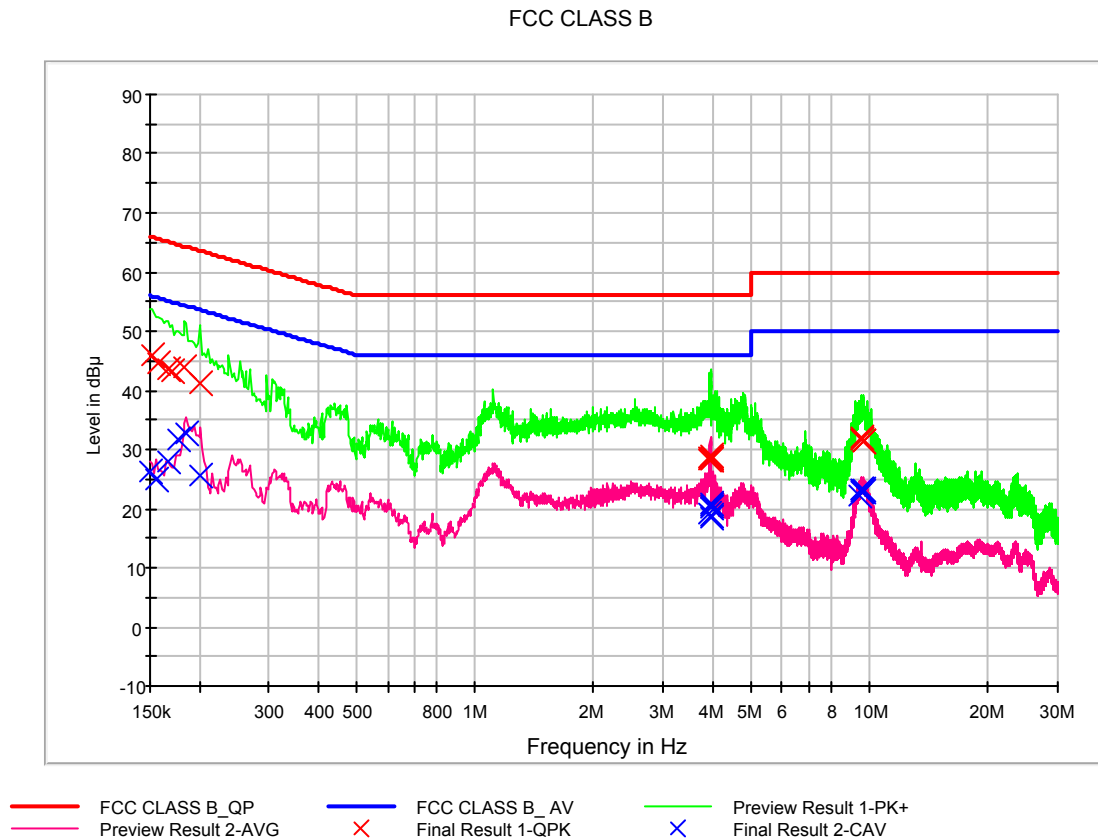
QuasiPeak Final Result, Line (L1)

Frequency (MHz)	QuasiPeak (dBuV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	47.4	9.000	L1	9.6	18.6	66.0
0.156000	46.8	9.000	L1	9.6	18.9	65.7
0.162000	45.6	9.000	L1	9.6	19.8	65.4
0.168000	44.7	9.000	L1	9.6	20.3	65.1
0.172000	44.4	9.000	L1	9.6	20.5	64.9
0.182000	45.4	9.000	L1	9.6	19.0	64.4
3.174000	35.5	9.000	L1	9.8	20.5	56.0
3.178000	35.2	9.000	L1	9.8	20.8	56.0
3.320000	35.5	9.000	L1	9.8	20.5	56.0
3.458000	35.3	9.000	L1	9.8	20.7	56.0
3.494000	35.6	9.000	L1	9.8	20.4	56.0
3.732000	34.2	9.000	L1	9.8	21.8	56.0
9.382000	39.2	9.000	L1	10.1	20.8	60.0
9.408000	39.3	9.000	L1	10.1	20.7	60.0
9.496000	38.3	9.000	L1	10.1	21.7	60.0
9.530000	38.9	9.000	L1	10.1	21.1	60.0
9.602000	38.1	9.000	L1	10.1	21.9	60.0
9.784000	36.0	9.000	L1	10.1	24.0	60.0



CAverage Final Result, Line (L1)

Frequency (MHz)	CAverage (dBuV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	26.8	9.000	L1	9.6	29.2	56.0
0.156000	26.1	9.000	L1	9.6	29.6	55.7
0.160000	27.3	9.000	L1	9.6	28.2	55.5
0.166000	28.7	9.000	L1	9.6	26.4	55.2
0.174000	27.9	9.000	L1	9.6	26.9	54.8
0.182000	34.3	9.000	L1	9.6	20.1	54.4
3.178000	25.9	9.000	L1	9.8	20.1	46.0
3.320000	26.5	9.000	L1	9.8	19.5	46.0
3.562000	25.9	9.000	L1	9.8	20.1	46.0
3.732000	24.1	9.000	L1	9.8	21.9	46.0
3.798000	23.5	9.000	L1	9.8	22.5	46.0
3.876000	22.0	9.000	L1	9.9	24.0	46.0
9.382000	29.4	9.000	L1	10.1	20.6	50.0
9.408000	29.4	9.000	L1	10.1	20.6	50.0
9.540000	29.9	9.000	L1	10.1	20.1	50.0
9.558000	29.7	9.000	L1	10.1	20.3	50.0
9.572000	29.6	9.000	L1	10.1	20.4	50.0
9.784000	26.6	9.000	L1	10.1	23.4	50.0

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



QuasiPeak Final Result, Line (N)

Frequency (MHz)	QuasiPeak (dBuV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.152000	45.8	9.000	N	9.6	20.1	65.9
0.158000	44.6	9.000	N	9.6	21.0	65.6
0.166000	43.6	9.000	N	9.6	21.5	65.2
0.170000	43.1	9.000	N	9.6	21.9	65.0
0.184000	44.0	9.000	N	9.6	20.3	64.3
0.200000	41.2	9.000	N	9.6	22.4	63.6
3.914000	28.3	9.000	N	9.8	27.7	56.0
3.934000	28.6	9.000	N	9.8	27.4	56.0
3.944000	28.4	9.000	N	9.8	27.6	56.0
3.948000	28.2	9.000	N	9.8	27.8	56.0
3.964000	28.8	9.000	N	9.8	27.2	56.0
3.968000	29.1	9.000	N	9.8	26.9	56.0
9.544000	31.8	9.000	N	10.1	28.2	60.0
9.548000	31.9	9.000	N	10.1	28.1	60.0
9.576000	31.7	9.000	N	10.1	28.3	60.0
9.596000	31.3	9.000	N	10.1	28.7	60.0
9.636000	31.3	9.000	N	10.1	28.7	60.0
9.702000	31.3	9.000	N	10.1	28.7	60.0



CAverage Final Result, Line (N)

Frequency (MHz)	CAverage (dBuV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	26.3	9.000	N	9.6	29.7	56.0
0.156000	25.0	9.000	N	9.6	30.7	55.7
0.166000	27.9	9.000	N	9.6	27.3	55.2
0.176000	31.7	9.000	N	9.6	23.0	54.7
0.186000	32.7	9.000	N	9.6	21.5	54.2
0.202000	25.4	9.000	N	9.6	28.1	53.5
3.926000	19.0	9.000	N	9.8	27.0	46.0
3.944000	18.7	9.000	N	9.8	27.3	46.0
3.948000	18.6	9.000	N	9.8	27.4	46.0
3.960000	20.2	9.000	N	9.8	25.8	46.0
3.966000	20.8	9.000	N	9.8	25.2	46.0
3.976000	20.6	9.000	N	9.8	25.4	46.0
9.440000	22.3	9.000	N	10.1	27.7	50.0
9.544000	23.2	9.000	N	10.1	26.8	50.0
9.548000	23.2	9.000	N	10.1	26.8	50.0
9.578000	22.9	9.000	N	10.1	27.1	50.0
9.596000	22.9	9.000	N	10.1	27.1	50.0
9.638000	23.1	9.000	N	10.1	26.9	50.0



5.2 Radiated Emission Test

The test results of radiated emission provide the following information:

-For Measurement Below 1 GHz

Rule Part / Standard	FCC PART 15 Subpart B Class B
Detector	Quasi-Peak
Bandwidth	120 kHz (6 dB)
Operation Mode	Data Communication mode
Kind of Test Site	3 m semi anechoic chamber
Temperature	21.9 °C
Relative Humidity	33.1 %
Test Date	March 09, 2017

Frequency (MHz)	Quasi Peak (dBuV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBuV/m)
83.076152	28.1	283.0	H	95.0	18.4	11.9	40.0
85.492985	27.7	265.0	H	100.0	18.0	12.3	40.0
240.342686	35.3	142.0	H	340.0	21.7	10.7	46.0
265.601203	34.2	100.0	H	309.0	22.6	11.8	46.0
275.877756	29.1	125.0	H	94.0	23.0	16.9	46.0
500.030060	32.1	165.0	V	17.0	28.8	13.9	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



-For Measurement Above 1 GHz

Rule Part / Standard	FCC PART 15 Subpart B Class B
Detector	Peak mode: Peak (RBW: 1 MHz, VBW: 3 MHz) CISPR-Average mode: Peak (RBW: 1 MHz, VBW: 10 Hz)
Highest Operating Frequency	2 480 MHz
Upper Frequency of Measurement Range	1 GHz to 12.4 GHz
Operation Mode	Data Communication mode
Kind of Test Site	3 m semi anechoic chamber
Temperature	21.9 °C
Relative Humidity	33.1 %
Test Date	March 09, 2017

Frequency (MHz)	Peak (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1399.749499	46.3	363.6	V	36.0	-12.8	27.7	74.0
2054.959919	48.5	100.0	V	224.0	-11.9	25.5	74.0
2658.266533	50.2	367.5	V	153.0	-9.1	23.8	74.0
2987.625251	41.2	346.6	V	153.0	-8.2	32.8	74.0
4480.511022	39.5	317.6	V	129.0	-5.7	34.5	74.0
7184.919840	46.6	150.1	V	173.0	2.1	27.4	74.0

Frequency (MHz)	CAverage (dBμV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1399.749499	43.3	363.6	V	36.0	-12.8	10.7	54.0
2054.959919	22.3	100.0	V	224.0	-11.9	31.7	54.0
2658.266533	23.7	367.5	V	153.0	-9.1	30.3	54.0
2987.625251	25.7	346.6	V	153.0	-8.2	28.3	54.0
4480.511022	25.5	317.6	V	129.0	-5.7	28.5	54.0
7184.919840	33.7	150.1	V	173.0	2.1	20.3	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



6. LIST OF TEST EQUIPMENT

<u>Type</u>	<u>Manufacturer</u>	<u>Model Name</u>	<u>Serial Number</u>	<u>Calibration Cycle</u>	<u>CAL Date</u>
<u>Conducted Emission</u>					
☒ EMI Test Receiver	Rohde & Schwarz	ESCI	100033	1 year	06.29.2016
☒ LISN	Rohde & Schwarz	ESH3-Z5	100282	1 year	06.09.2016
☒ LISN	Rohde & Schwarz	ENV216	100073	1 year	12.23.2016
☒ Software	Rohde & Schwarz	EMC32	-	-	-
<u>Radiated Emission</u>					
-For measurement below 1 GHz					
☒ EMI Test Receiver	Rohde & Schwarz	ESI40	831564103	1 year	11.04.2016
☐ EMI Test Receiver	Rohde & Schwarz	ESU40	100514	1 year	10.10.2016
☒ Trilog Antenna	Schwarzbeck	VULB9168	255	2 year	04.15.2015
☒ 6dB Attenuator	HP	8491A	24257	2 year	04.15.2015
☒ Antenna master	HD GmbH	MA240	240/520	N/A	-
☒ Antenna master controller	HD GmbH	HD 100	100/637	N/A	-
☒ Turn Table	EMCO	1060-2M	-	N/A	-
☒ Turn Table controller	EMCO	2090	9702-1224	N/A	-
☐ EMI Test Receiver	Rohde & Schwarz	ESU 26	100241	1 year	05.27.2016
☐ Antenna master	INNCO Systems	MA4000-EP	MA4000/283	N/A	-
☐ Turn Table	INNCO Systems	DT3000-3T	DT3000/69	N/A	-
☒ Software	Rohde & Schwarz	EMC32	-	-	-
-For measurement above 1 GHz					
☒ EMI Test Receiver	Rohde & Schwarz	ESI40	831564103	1 year	11.04.2016
☐ EMI Test Receiver	Rohde & Schwarz	ESU40	100514	1 year	10.10.2016
☐ Antenna master	HD GmbH	MA240	240/520	N/A	-
☐ Antenna master controller	HD GmbH	HD 100	100/637	N/A	-
☒ Antenna master	INNCO Systems	MA4000-XP-ET	48709515	N/A	-
☒ Antenna master controller	INNCO Systems	CO 3000	CO 3000/870/ 35990515	N/A	-
☒ Turn Table	EMCO	1060-2M	-	N/A	-
☒ Turn Table controller	EMCO	2090	9702-1224	N/A	-
☐ Power Amplifier	CERNEX	CBLU1183540	21691	1 year	07.04.2016
☒ Power Amplifier	CERNEX	CBLU5183530	24348	1 year	06.07.2016
☒ Horn Antenna	Schwarzbeck	BBHA 9120D	296	2 year	10.12.2016
☐ Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170541	2 year	09.03.2015
☐ Power Amplifier	CERNEX	CBL18265035	21873	1 year	01.19.2017
☐ Power Amplifier	CERNEX	CBL26405040	19660	1 year	07.15.2016
☐ Horn Antenna	Schwarzbeck	BBHA 9120D	1300	2 year	08.25.2016
☐ EMI Test Receiver	Rohde & Schwarz	ESU 26	100241	1 year	05.27.2016
☐ Turn Table	INNCO Systems	DT3000-3T	DT3000/69	N/A	-
☒ Software	Rohde & Schwarz	EMC32	-	-	-



7. CONCLUSION

The data collected shows that the **EUT Type: Multi-band GSM/WCDMA/LTE phone with BT and WLAN, Model: LG-VN220, FCC ID: ZNFVN220** complies with §15.107 and §15.109 of the FCC rules.