

EMI TEST REPORT

FCC CERTIFICATION / ISED

Applicant:

LG Electronics, Inc.
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Gyeongsangnam-do, 51554, Korea

Date of Issue: October 29, 2018

Test Report No. HCT-EM-1810-FI002

Test Site: HCT CO., LTD.

FCC ID
IC

BEJ-LZM001
2703N-LZM001

Rule Part(s) / Standard(s): FCC CFR 47 PART 15 Subpart B Class B
ICES-003 Issue 6 Class B / ANSI C63.4-2014

EUT Type: Zigbee Module

Model Name: LZM-001

Date of Test: October 17, 2018

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

Tested By



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REVISION HISTORY

The revision history for this document is shown in table.

Report No.	Issue Date	Information about Changes
HCT-EM-1810-FI002	October 29, 2018	Initial Release



TABLE OF CONTENTS

	PAGE
1. GENERAL INFORMATION	4
1.1 Description of EUT	4
1.2 Tested System Details	4
1.3 Cable Description	5
1.4 Noise Suppression Parts on Cable. (I/O Cable)	5
1.5 Test Facility	6
1.6 Calibration of Measuring Instrument	6
1.7. Measurement Uncertainty	6
2. LIST OF TEST EQUIPMENT	7
3. DESCRIPTION OF TEST	8
3.1 Measurement of Conducted Emission	8
3.2 Measurement of Radiated Emission	9
4. PRELIMINARY TEST	11
4.1 Conducted Emission Test	11
4.2 Radiated Emission Test	11
5. CONDUCTED AND RADIATED EMISSION TEST SUMMARY	12
5.1 Conducted Emission Test	12
5.2 Radiated Emission Test	19
6. CONCLUSION	21
7. APPENDIX A. TEST SETUP PHOTOGRAPHS	22



1. GENERAL INFORMATION

1.1 Description of EUT

Its basic purpose is used for communications.

FCC ID	BEJ-LZM001
IC	2703N-LZM001
Model	LZM-001
EUT Type	Zigbee Module
Frequency	2 405 MHz to 2 480 MHz
Power rating	5 VDC
Manufacturer	LG Electronics Inc.
Factory Name / Address	LG Innotek Indonesia PT. Bekasi International Estate Block C8 NO.12&12A Lemahabang Bekasi Timur 17550 Jawa Barat, Indonesia

1.2 Tested System Details

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

Device Type	Model Name	Serial Number	Manufacturer	FCC ID/DoC/IC
EUT	LZM-001	-	LG Electronics	BEJ-LZM001 2703N-LZM001
Test JIG	-	-	-	-
AC/DC adaptor	A1487	-	Flextronics power systems (Dongguan)	-



1.3 Cable Description

Product Name	Port	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (m)
EUT	4 PIN	N	N	(P,D)0.1
Test JIG	2 PIN	N	N/A	(P)1.0

* 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	4 PIN	N	N/A	N	N/A
Test JIG	2 PIN	N	N/A	Y	AC/DC Adaptor 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	Registration Number
Radiated Field strength measurement facility 3 m Semi Anechoic chamber	90661
Radiated Field strength measurement facility 10 m Semi Anechoic chamber	
Filing the EMI Measurement Facility (3 m Semi Anechoic Chamber and Shielded Room)	IC 5944A-4
Filing the EMI Measurement Facility (10 m Semi-Anechoic Chamber)	IC 5944A-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 (dB)
Conducted Emission (0.15 MHz to 30 MHz)	1.82 dB
3 m Radiated Emissions (30 MHz to 1 GHz)	5.20 dB
3 m Radiated Emissions (1 GHz to 18 GHz)	5.24 dB
3 m Radiated Emissions (18 GHz to 40 GHz)	5.40 dB



2. 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>					
<input checked="" type="checkbox"/> EMI Test Receiver	Rohde & Schwarz	ESCI	100033	1 year	06.27.2018
<input checked="" type="checkbox"/> LISN	Rohde & Schwarz	ENV216	102245	1 year	12.20.2017
<input type="checkbox"/> LISN	Rohde & Schwarz	ENV216	100073	1 year	05.03.2018
<input checked="" type="checkbox"/> Software	Rohde & Schwarz	EMC32 VER8.54.0	-	-	-
<u>Radiated Emission</u>					
-For measurement below 1 GHz					
<input checked="" type="checkbox"/> EMI Test Receiver	Rohde & Schwarz	ESU40	100524	1 year	07.27.2018
<input checked="" type="checkbox"/> Trilog Antenna	Schwarzbeck	VULB 9168	760	2 year	04.06.2017
<input checked="" type="checkbox"/> Antenna master	INNCO Systems	MA4640-XP-ET	-	N/A	-
<input checked="" type="checkbox"/> Antenna master controller	INNCO Systems	CO 3000	CO3000/870/ 35990515/L	N/A	-
<input checked="" type="checkbox"/> Turn Table	INNCO Systems	1060	-	N/A	-
<input checked="" type="checkbox"/> Turn Table controller	INNCO Systems	CO2000	CO2000/095/ 7590304/L	N/A	-
<input type="checkbox"/> EMI Test Receiver	Rohde & Schwarz	ESU26	100241	1 year	08.14.2018
<input type="checkbox"/> Antenna master	INNCO Systems	MA4000-EP	MA4000/283	N/A	-
<input type="checkbox"/> Turn Table	INNCO Systems	DT3000-3T	DT3000/69	N/A	-
<input checked="" type="checkbox"/> Software	Rohde & Schwarz	EMC32 VER8.40.0	-	-	-
-For measurement above 1 GHz					
<input checked="" type="checkbox"/> EMI Test Receiver	Rohde & Schwarz	ESU40	100524	1 year	07.27.2018
<input checked="" type="checkbox"/> Antenna master	INNCO Systems	MA4640-XP-ET	-	N/A	-
<input checked="" type="checkbox"/> Antenna master controller	INNCO Systems	CO3000	CO3000/870/ 35990515/L	N/A	-
<input checked="" type="checkbox"/> Turn Table	INNCO Systems	1060	-	N/A	-
<input checked="" type="checkbox"/> Turn Table controller	INNCO Systems	CO2000	CO2000/095/ 7590304/L	N/A	-
<input checked="" type="checkbox"/> Horn Antenna	Schwarzbeck	BBHA 9120D	01836	2 year	05.14.2018
<input checked="" type="checkbox"/> Low Noise Amplifier	TESTEK	TK-PA18H	170034-L	1 year	03.06.2018
<input type="checkbox"/> Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170#786	2 year	12.05.2017
<input type="checkbox"/> Power Amplifier	TESTEK	TK-PA1840H	170030-L	1 year	12.20.2017
<input type="checkbox"/> Antenna master controller	HD GmbH	HD 100	100/637	N/A	-
<input type="checkbox"/> Power Amplifier	CERNEX	CBLU1183540	21691	1 year	06.25.2018
<input type="checkbox"/> Antenna master	HD GmbH	MA240	240/520	N/A	-
<input type="checkbox"/> EMI Test Receiver	Rohde & Schwarz	ESU26	100241	1 year	08.14.2018
<input type="checkbox"/> Turn Table	INNCO Systems	DT3000-3T	DT3000/69	N/A	-
<input checked="" type="checkbox"/> Software	Rohde & Schwarz	EMC32 VER8.40.0	-	-	-



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

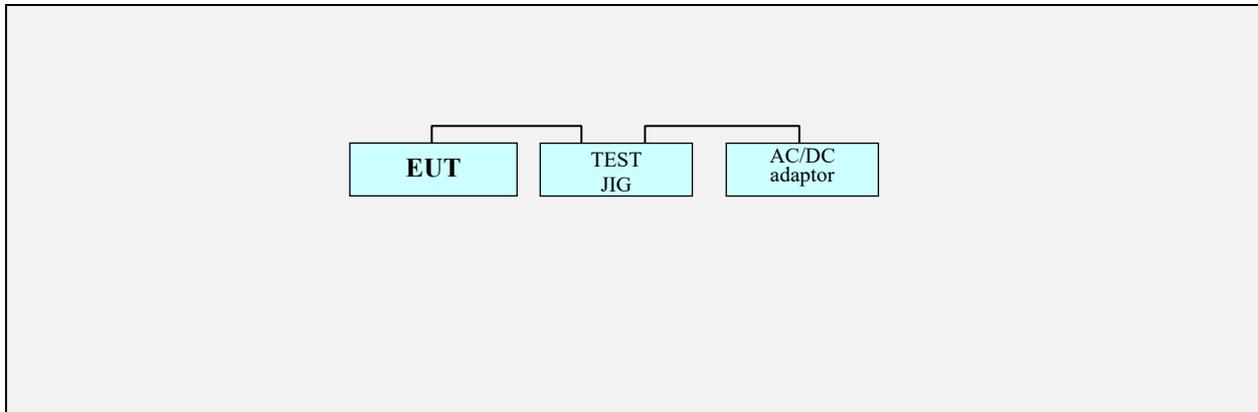


3.2.1 Frequency Range of Radiated Measurements

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



Non-Conductive Table
 Power Line: 120 VAC, 60 Hz



4. PRELIMINARY TEST

4.1 Conducted Emission Test

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

Operation Mode: ZIGBEE Idle mode

4.2 Radiated Emission Test

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

Operation Mode: ZIGBEE Idle 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:

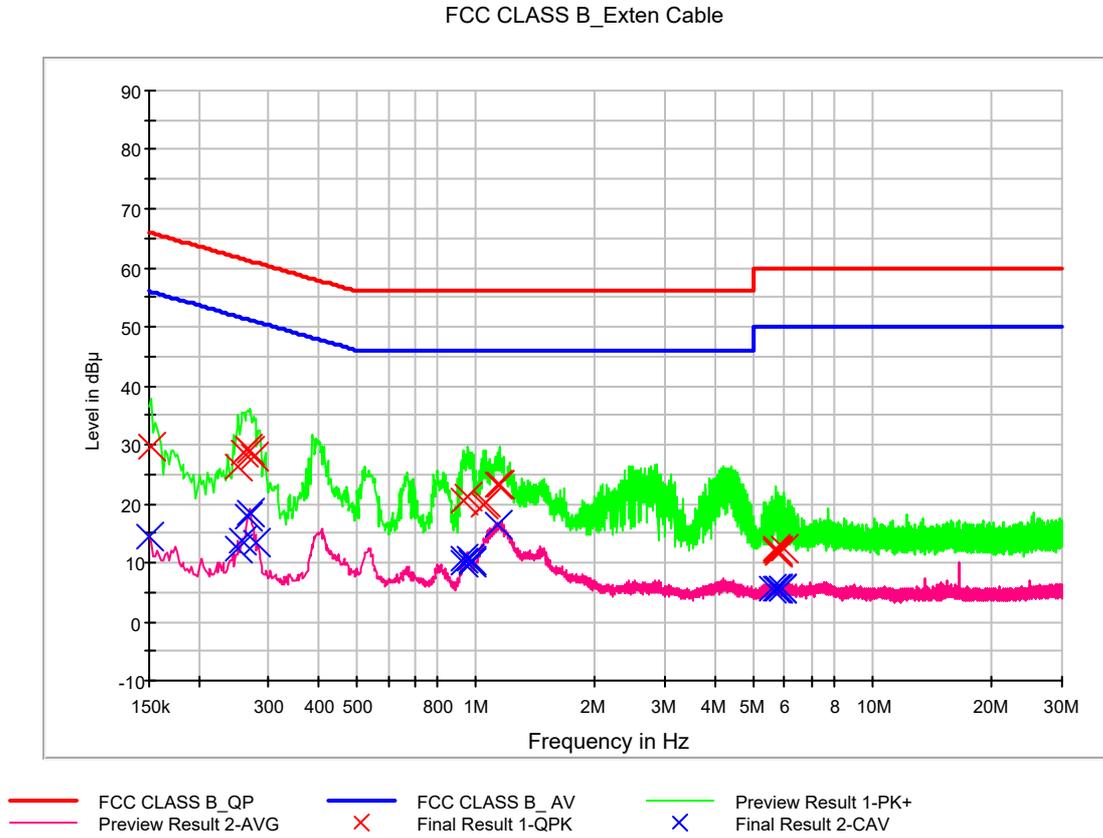
Rule Part / Standard	FCC PART 15 Subpart B Class B ICES-003 Issue 6 Class B / ANSI C63.4-2014
Detector	Quasi-Peak, CISPR-Average
Bandwidth	9 kHz (6 dB)
Operation Mode	ZIGBEE Idle mode
Kind of Test Site	Shielded Room
Temperature	23.3 °C
Relative Humidity	43.1 %
Test Date	October 17, 2018

- 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: 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)
0.152000	29.6	9.000	L1	9.7	36.3	65.9
0.252000	26.4	9.000	L1	9.7	35.3	61.7
0.260000	28.6	9.000	L1	9.7	32.8	61.4
0.266000	29.2	9.000	L1	9.7	32.0	61.2
0.270000	29.1	9.000	L1	9.7	32.0	61.1
0.274000	28.1	9.000	L1	9.7	32.9	61.0
0.932000	20.4	9.000	L1	9.8	35.6	56.0
0.956000	21.1	9.000	L1	9.8	34.9	56.0
1.046000	19.9	9.000	L1	9.8	36.1	56.0
1.060000	20.1	9.000	L1	9.8	35.9	56.0
1.136000	23.3	9.000	L1	9.8	32.7	56.0
1.142000	23.1	9.000	L1	9.8	32.9	56.0
5.668000	12.5	9.000	L1	10.0	47.5	60.0
5.686000	12.0	9.000	L1	10.0	48.0	60.0
5.746000	11.6	9.000	L1	10.0	48.4	60.0
5.760000	11.6	9.000	L1	10.0	48.4	60.0
5.768000	12.1	9.000	L1	10.0	47.9	60.0
5.964000	12.3	9.000	L1	10.0	47.7	60.0

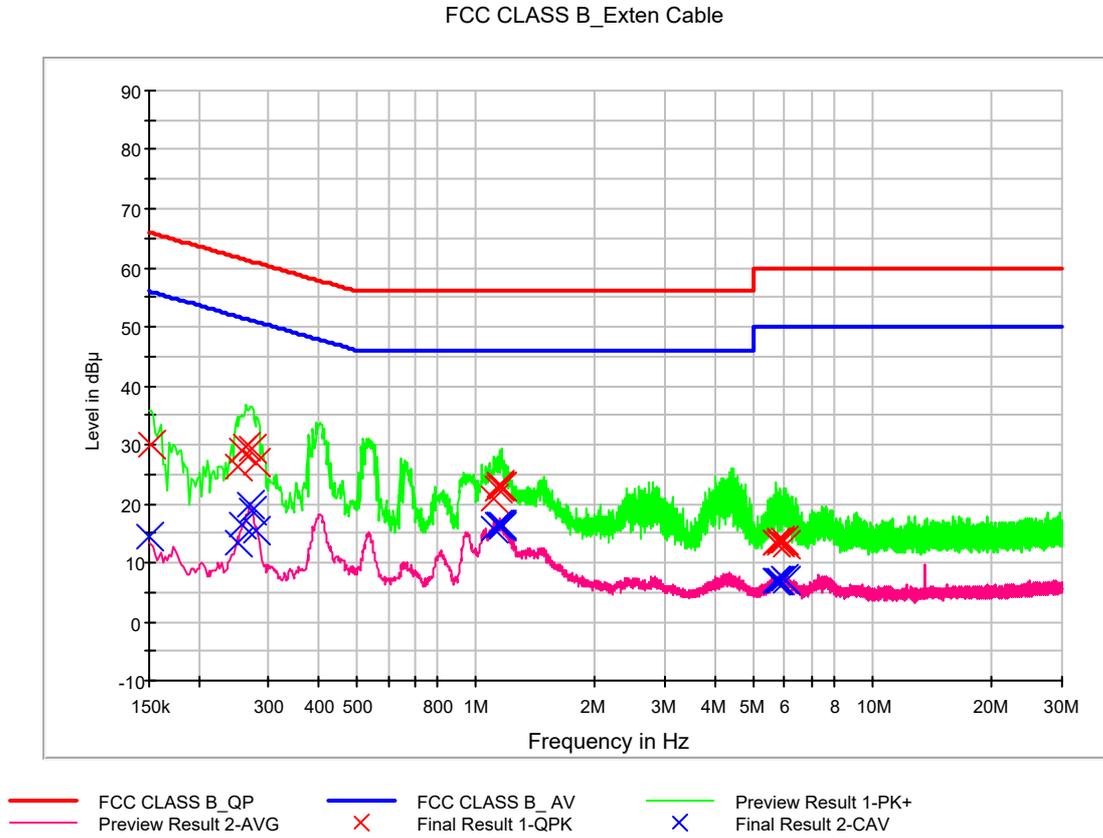


CAverage Final Result, Line (L1)

Frequency (MHz)	CAverage (dBuV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	14.3	9.000	L1	9.7	41.7	56.0
0.252000	12.3	9.000	L1	9.7	39.4	51.7
0.256000	13.6	9.000	L1	9.7	37.9	51.6
0.266000	17.7	9.000	L1	9.7	33.5	51.2
0.270000	18.4	9.000	L1	9.7	32.7	51.1
0.278000	13.5	9.000	L1	9.7	37.4	50.9
0.928000	10.2	9.000	L1	9.8	35.8	46.0
0.932000	10.5	9.000	L1	9.8	35.5	46.0
0.964000	10.8	9.000	L1	9.8	35.2	46.0
0.972000	10.2	9.000	L1	9.8	35.8	46.0
0.976000	9.9	9.000	L1	9.8	36.1	46.0
1.136000	16.4	9.000	L1	9.8	29.6	46.0
5.592000	5.5	9.000	L1	10.0	44.5	50.0
5.686000	5.7	9.000	L1	10.0	44.3	50.0
5.760000	5.6	9.000	L1	10.0	44.4	50.0
5.768000	5.6	9.000	L1	10.0	44.4	50.0
5.924000	5.7	9.000	L1	10.0	44.3	50.0
5.934000	5.7	9.000	L1	10.0	44.3	50.0



Figure 2: 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	29.9	9.000	N	9.7	36.0	65.9
0.250000	26.2	9.000	N	9.7	35.5	61.8
0.258000	28.9	9.000	N	9.7	32.6	61.5
0.264000	29.8	9.000	N	9.7	31.5	61.3
0.272000	29.5	9.000	N	9.7	31.6	61.1
0.280000	27.1	9.000	N	9.7	33.7	60.8
1.112000	21.0	9.000	N	9.8	35.0	56.0
1.134000	22.4	9.000	N	9.8	33.6	56.0
1.144000	23.1	9.000	N	9.8	32.9	56.0
1.152000	23.0	9.000	N	9.8	33.0	56.0
1.158000	22.8	9.000	N	9.8	33.2	56.0
1.166000	22.7	9.000	N	9.8	33.3	56.0
5.676000	13.4	9.000	N	10.1	46.6	60.0
5.684000	13.5	9.000	N	10.1	46.5	60.0
5.826000	13.3	9.000	N	10.1	46.7	60.0
5.832000	13.7	9.000	N	10.1	46.3	60.0
5.970000	13.6	9.000	N	10.1	46.4	60.0
6.028000	13.2	9.000	N	10.1	46.8	60.0



CAverage Final Result, Line (N)

Frequency (MHz)	CAverage (dBuV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.150000	14.4	9.000	N	9.7	41.6	56.0
0.250000	13.3	9.000	N	9.7	38.4	51.8
0.258000	16.4	9.000	N	9.7	35.1	51.5
0.268000	19.9	9.000	N	9.7	31.3	51.2
0.272000	18.7	9.000	N	9.7	32.4	51.1
0.280000	15.4	9.000	N	9.7	35.4	50.8
1.112000	15.7	9.000	N	9.8	30.3	46.0
1.134000	16.4	9.000	N	9.8	29.6	46.0
1.144000	16.4	9.000	N	9.8	29.6	46.0
1.152000	16.5	9.000	N	9.8	29.5	46.0
1.160000	16.4	9.000	N	9.8	29.6	46.0
1.166000	16.1	9.000	N	9.8	29.9	46.0
5.684000	7.1	9.000	N	10.1	42.9	50.0
5.704000	7.1	9.000	N	10.1	42.9	50.0
5.770000	6.8	9.000	N	10.1	43.2	50.0
5.826000	7.1	9.000	N	10.1	42.9	50.0
5.974000	7.2	9.000	N	10.1	42.8	50.0
6.028000	6.9	9.000	N	10.1	43.1	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 ICES-003 Issue 6 Class B / ANSI C63.4-2014
Detector	Quasi-Peak
Bandwidth	120 kHz (6 dB)
Operation Mode	ZIGBEE Idle mode
Kind of Test Site	3 m semi anechoic chamber
Temperature	22.9 °C
Relative Humidity	45.2 %
Test Date	October 17, 2018

Frequency (MHz)	Quasi Peak (dB μ V/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
31.820000	18.1	175.0	V	142.0	18.9	21.9	40.0
49.374400	18.0	307.8	V	180.0	20.3	22.0	40.0
72.182400	14.9	325.1	V	162.0	17.5	25.1	40.0
160.066400	20.5	99.9	V	281.0	20.2	23.0	43.5
461.072800	23.1	208.0	V	83.0	24.3	22.9	46.0
700.666400	28.5	274.8	V	154.0	28.7	17.5	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 ICES-003 Issue 6 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 Operating Frequency	2 480 MHz
Tested Frequency Range	1 GHz to 18 GHz
Operation Mode	ZIGBEE Idle mode
Kind of Test Site	3 m semi anechoic chamber
Temperature	22.9 °C
Relative Humidity	45.2 %
Test Date	October 17, 2018

Frequency (MHz)	Peak (dBµV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1640.930000	30.6	399.9	H	334.0	-27.5	43.4	74.0
2708.815000	33.0	113.4	V	222.0	-24.0	41.0	74.0
4346.450000	34.7	149.5	V	98.0	-19.9	39.3	74.0
7406.545000	41.6	349.6	V	119.0	-13.0	32.4	74.0
9155.095000	43.9	99.8	V	206.0	-11.0	30.1	74.0
9863.920000	43.7	217.4	V	83.0	-9.5	30.3	74.0

Frequency (MHz)	CAverage (dBµV/m)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1640.930000	18.1	399.9	H	334.0	-27.5	35.9	54.0
2708.815000	20.1	113.4	V	222.0	-24.0	33.9	54.0
4346.450000	22.3	149.5	V	98.0	-19.9	31.7	54.0
7406.545000	28.4	349.6	V	119.0	-13.0	25.6	54.0
9155.095000	30.6	99.8	V	206.0	-11.0	23.4	54.0
9863.920000	31.0	217.4	V	83.0	-9.5	23.0	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. CONCLUSION

The data collected shows that the **EUT Type: Zigbee Module, Model: LZM-001** complies with §15.107 and §15.109 of the FCC rules and ICES-003 Issue 6 of the IC rules.



7. APPENDIX A. TEST SETUP PHOTOGRAPHS

Please refer to Appendix A