RF Exposure Evaluation declaration

Product Name : LTE Module

Model No. : IMG3-VT

FCC ID : NKR-IMG3-VT

Applicant : Wistron NeWeb Corporation

Address : 20 Park Avenue II, Hsinchu Science Park, Hsinchu 308, Taiwan

Date of Receipt : May. 21, 2020

Date of Declaration : Jul. 22, 2020

Report No. : 2050525R-E3082100013

Report Version : V1.0

Testing Laboratory
3023

Issued Date: Jul. 22, 2020
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Product Name	LTE Module	
Applicant	Wistron NeWeb Corporation	
Address	20 Park Avenue II, Hsinchu Science Park, Hsinchu 308, Taiwan	
Manufacturer	Wistron NeWeb Corporation	
Model No.	IMG3-VT	
FCC ID.	NKR-IMG3-VT	
Trade Name	WNC	
Applicable Standard	KDB 447498 D01 v06	☒ Minimum test separation distance ≥ 20 cm ☐ For low power devices
Test Result	Complied	

Documented By : Peggy Tu
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Tested By : Vorana Chen
(Senior Engineer / Vorana Chen)

Approved By :
(Director / Vincent Lin)

Revision History

Report No.	Version	Description	Issued Date
2050525R-E3082100013	V1.0	Initial issue of report.	2020-07-22

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	LTE Module
Model No.	IMG3-VT
Trade Name	WNC
IMEI No 29	353450100324130
IMEI No 30	353450100324140
FCC ID	NKR-IMG3-VT
TX Frequency	LTE Band 2: 1850 MHz ~1910 MHz LTE Band 4: 1710 MHz~1755 MHz LTE Band 5: 824 MHz ~849 MHz LTE Band 13: 777 MHz ~787 MHz LTE Band 66:1710 MHz~1780 MHz
Rx Frequency	LTE Band 2: 1930 MHz ~1990 MHz LTE Band 4: 2110 MHz ~2155 MHz LTE Band 5: 869 MHz ~894 MHz LTE Band 13: 746 MHz ~756 MHz LTE Band 66: 2110 MHz ~2200 MHz
2UL CA list	CA_2A-2A, CA_2A-4A, CA_2A-5A, CA_2A-13A, CA_2A-66A, CA_4A-4A, CA_4A-5A, CA_4A-13A, CA_5A-66A, CA_5B, CA_13A-2A, CA_13A-4A CA_13A-66A, CA_66B, CA_66C.
HW Version	0.0.1
SW Version	ARM0:0.70.3.0.0 ARM1:1.0.0.0
Antenna Type	Dipole Antenna

1.2. Antenna List :

No	Manufacturer	Part No	Antenna Type	Peak Gain
1	Wieson Technologies Co., Ltd.	GY115	Dipole Antenna	1.66dBi for 746-787MHz 3.20dBi for 824-894MHz 1.62dBi for 1710-1785MHz 1.56dBi for 1850-1910MHz

2. RF Exposure Evaluation

2.1. Limits

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (Minutes)
(A) Limits for Occupational/ Control Exposures				
300-1500	--	--	F/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/ Uncontrolled Exposures				
300-1500	--	--	F/1500	30
1500-100,000	--	--	1	30

F= Frequency in MHz

Friis Formula

Friis transmission formula: $Pd = (Pout*G)/(4*Pi*R^2)$

Where

Pd = power density in mW/cm^2

Pout = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

R = distance between observation point and center of the radiator in cm

Pd is the limit of MPE, 1 mW/cm^2. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0

2.2. Test Result of RF Exposure Evaluation

Product : LTE Module
Test Item : RF Exposure Evaluation
Test Site : N/A

Peak Gain:LTE Band 2: 1.56dBi, LTE Band 5: 3.2dBi, LTE Band 13: 1.66dBi, LTE Band 66: 1.62dBi

Frequency	Tune up Peak Power (dBm)	Tune up ERP/EIRP (W)	Maximum ERP/EIRP Limit (W)	Duty Cycle (%)	Tune up Average Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit (mW/cm^2)	Pass/Fail
LTE B2 (Standalone)	25.70	0.532	2	100	25.7	371.54	0.1059	1	Pass
LTE B5 (Standalone)	25.70	0.473	7	100	25.7	371.54	0.1544	0.5498	Pass
LTE B13 (Standalone)	25.70	0.332	3	100	25.7	371.54	0.1083	0.5213	Pass
LTE B4/66 (Standalone)	25.70	0.540	1	100	25.7	371.54	0.1073	1	Pass
CA_5B	25.70	0.473	7	100	25.7	371.54	0.1544	0.5498	Pass
CA_66B	25.70	0.540	1	100	25.7	371.54	0.1073	1	Pass
CA_66C	25.70	0.540	1	100	25.7	371.54	0.1073	1	Pass

2.3. Calculations for Multi-Transsmitter

Worst case Mode (4A+5A / 5A+66A)	Power Density at R = 20 cm (mW/cm2)	Limit (mW/cm2)	result	Limit	Pass/Fail
LTE B5	0.1544	0.5498	0.388	1	Pass
LTE B4/66	0.1073	1			

2.4. Maximum Antenna Gain Evaluation (Reference Only)

LTE Band	Frequency (MHz)	Maximum tune up Power (dBm)	Max Gain to comply with ERP/EIRP		Max Gain to comply with MPE		
			Antenna Gain(dBi)	Maximum ERP/EIRP Limit (W)	Antenna Gain(dBi)	Distance (cm)	Limit (mW/cm^2)
Band 2	1850 ~ 1910	25.70	7.31	2.0	11.31	20	1.00
Band 5	824 ~ 849	25.70	14.91	7.0	8.71	20	0.5493
Band 13	779 ~ 785	25.70	11.22	3.0	8.47	20	0.5193
Band 4/66	1710 ~ 1780	25.70	4.30	1.0	11.31	20	1.00

Frequency	Tune up Average Power (dBm)	Antenna Gain(dBi)	Tune up ERP/EIRP (W)	Maximum ERP/EIRP Limit (W)	Duty Cycle (%)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit (mW/cm^2)	Pass/Fail
LTE B2	25.70	7.31	2	2	100	371.54	0.3979	1	Pass
LTE B5	25.70	5.70	0.841	7	100	371.54	0.2746	0.5498	Pass
LTE B13	25.70	5.46	0.796	3	100	371.54	0.2599	0.5213	Pass
LTE B4/66	25.70	4.30	1	1	100	371.54	0.1989	1	Pass

2.5. Calculations for Multi-Transsmitter

Worst case Mode (2A+5A)	Power Density at R = 20 cm (mW/cm2)	Limit (mW/cm2)	result	Limit	Pass/Fail
LTE B2	0.3979	1	0.8973	1	Pass
LTE B5	0.2746	0.5498			

Note: In order to comply with both ERP/EIRP and Maximum Permissible Exposure limit.
The maximum antenna gain shall not be greater than 7.31 dBi in LTE Band 2.
The maximum antenna gain shall not be greater than 5.70 dBi in LTE Band 5.
The maximum antenna gain shall not be greater than 5.46 dBi in LTE Band 13.
The maximum antenna gain shall not be greater than 4.30 dBi in LTE Band 4/66.