

RF Exposure Report

Report No.: SA160901E04

FCC ID: Z3M-E2100

Test Model: E2100

Received Date: Sep. 01, 2016

Test Date: Oct. 25 to Nov. 11, 2016

Issued Date: Jan. 05, 2017

Applicant: Greenwave Systems Pte. Ltd.

Address: 10 Science Park Road, #02-07/08, The Alpha (Science Park II), Singapore
117684

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Hsin Chu Laboratory

Lab Address: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan R.O.C.

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Table of Contents

Release Control Record	3
1 Certificate of Conformity	4
2 RF Exposure	5
2.1 Limits For Maximum Permissible Exposure (MPE)	5
2.2 MPE Calculation Formula	5
2.3 Classification	5
2.4 Antenna Gain	6
2.5 Calculation Result Of Maximum Conducted Power	7

Release Control Record

Issue No.	Description	Date Issued
SA160901E04	Original release.	Jan. 05, 2017

1 Certificate of Conformity

Product: Wi-Fi Extender

Brand: NA

Test Model: E2100

Sample Status: MASS-PRODUCTION

Applicant: Greenwave Systems Pte. Ltd.

Test Date: Oct. 25 to Nov. 11, 2016

Standards: FCC Part 2 (Section 2.1091)

KDB 447498 D01 General RF Exposure Guidance v06

IEEE C95.1-1992

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by :




Date:

Jan. 05, 2017

Midoli Peng / Specialist

Approved by :



Date:

Jan. 05, 2017

May Chen / Manager

2 RF Exposure

2.1 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)
Limits For General Population / Uncontrolled Exposure				
300-1500	F/1500	30
1500-100,000	1.0	30

F = Frequency in MHz

2.2 MPE Calculation Formula

$$Pd = (Pout * G) / (4 * \pi * r^2)$$

where

Pd = power density in mW/cm²

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

2.3 Classification

The antenna of this product, under normal use condition, is at least 32cm away from the body of the user.

So, this device is classified as **Mobile Device**.

2.4 Antenna Gain

The antennas provided to the EUT, please refer to the following table:

No.	PCB Chain No	Brand	Antenna Gain(dBi) Including cable loss	Frequency range (GHz~GHz)	Antenna Type	Connector type	Cable Length (mm)
2G-1	Chain2	WNC	4.62	2.4~2.4835	Dipole	i-pex(MHF)	75
2G-2	Chain1	WNC	3.33	2.4~2.4835	Dipole	i-pex(MHF)	52
2G-3	Chain0	WNC	3.63	2.4~2.4835	Dipole	i-pex(MHF)	187
5G-5	Chain3	WNC	3.24	5.15~5.25	Dipole	i-pex(MHF)	171
			3.24	5.25~5.35			
5G-6	Chain2	WNC	4.39	5.15~5.25	Dipole	i-pex(MHF)	187
			4.58	5.25~5.35			
5G-7	Chain1	WNC	3.68	5.15~5.25	Dipole	i-pex(MHF)	228
			3.62	5.25~5.35			
5G-8	Chain0	WNC	4.63	5.15~5.25	Dipole	i-pex(MHF)	237
			4.07	5.25~5.35			
5G-1	Chain3	WNC	3.45	5.47~5.725	Dipole	i-pex(MHF)	171
			3.45	5.725~5.85			
5G-2	Chain2	WNC	4.28	5.47~5.725	Dipole	i-pex(MHF)	187
			4.47	5.725~5.85			
5G-3	Chain1	WNC	4.01	5.47~5.725	Dipole	i-pex(MHF)	228
			3.54	5.725~5.85			
5G-4	Chain0	WNC	2.71	5.47~5.725	Dipole	i-pex(MHF)	237
			2.95	5.725~5.85			

The Directional gain table:

Frequency (MHz)	Max Gain (dBi)
UNII-1 band	3.97
UNII-2A band	4.29
UNII-2C band	5.21
UNII-3 band	4.88

Note:

1. Non-TxBF mode & TxBF mode antenna gain refer to KDB 662911 F 2) f) (ii)

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

where

Each antenna is driven by no more than one spatial stream;

N_{SS} = the number of independent spatial streams of data;

N_{ANT} = the total number of antennas

$g_{j,k} = 10^{G_k/20}$ if the k th antenna is being fed by spatial stream j , or zero if it is not;

G_k is the gain in dBi of the k th antenna.

2.5 Calculation Result of Maximum Conducted Power

Frequency (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)
2412-2462	896.52	8.65	32	0.51056	1
5180-5240	767.196	3.97	32	0.14873	1
5260-5320	249.65	4.29	32	0.05210	1
5500-5720	231.867	5.21	32	0.05980	1
5745-5825	897.877	4.88	32	0.21464	1

NOTE:

2.4GHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + 10^{G3/20})^2 / 3] = 8.65\text{dBi}$

5 GHz: Directional gain = 3.97dBi(UN-II-1), 4.29dBi(UN-II-2A), 5.21dBi(UN-II-2C), 4.88dBi(UN-II-3)

Conclusion:

The formula of calculated the MPE is:

$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$

CPD = Calculation power density

LPD = Limit of power density

Simultaneously transmission condition.

Technology		
WLAN (2.4GHz)	WLAN (5GHz <U-NII-1 & U-NII-2A>)	WLAN (5GHz <U-NII-2C & U-NII-3>)

$0.51056/1 + 0.14873/1 + 0.21464/1 = 0.87393$

Therefore the maximum calculations of above situations are less than the "1" limit.

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