RF Exposure Report

Report No.:	SA160901E04A
FCC ID:	Z3M-E2100
Test Model:	E2100
Received Date:	Sep. 01, 2016
Test Date:	Oct. 25 to Nov. 11, 2016
Issued Date:	Mar. 06, 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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Release Control Record

Issue No.	Description	Date Issued
SA160901E04A	Original release.	Mar. 06, 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:** Mar. 06, 2017

Midoli Peng / Specialist

Approved by : _____ , **Date:** Mar. 06, 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/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

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	Chain 2	WNC	4.62	2.4~2.4835	Dipole	i-pex(MHF)	75
2G-2	Chain 1	WNC	3.33	2.4~2.4835	Dipole	i-pex(MHF)	52
2G-3	Chain 0	WNC	3.63	2.4~2.4835	Dipole	i-pex(MHF)	187
5G-5	Chain 3	WNC	3.24	5.15~5.25	Dipole	i-pex(MHF)	171
			3.24	5.25~5.35			
5G-6	Chain 2	WNC	4.39	5.15~5.25	Dipole	i-pex(MHF)	187
			4.58	5.25~5.35			
5G-8	Chain 1	WNC	4.63	5.15~5.25	Dipole	i-pex(MHF)	237
			4.07	5.25~5.35			
5G-7	Chain 0	WNC	3.68	5.15~5.25	Dipole	i-pex(MHF)	228
			3.62	5.25~5.35			
5G-1	Chain 3	WNC	3.45	5.47~5.725	Dipole	i-pex(MHF)	43
			3.45	5.725~5.85			
5G-2	Chain 2	WNC	4.28	5.47~5.725	Dipole	i-pex(MHF)	37
			4.47	5.725~5.85			
5G-4	Chain 1	WNC	2.71	5.47~5.725	Dipole	i-pex(MHF)	90
			2.95	5.725~5.85			
5G-3	Chain 0	WNC	4.01	5.47~5.725	Dipole	i-pex(MHF)	73
			3.54	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 kth antenna is being fed by spatial stream j, or zero if it is not;

G_k is the gain in dBi of the kth antenna.

2.5 Calculation Result of Maximum Conducted Power

For 15.247 data was copied from the original test report (Report No.: SA160901E04)

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] = 8.65dBi
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 + ……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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