RF EXPOSURE REPORT

REPORT NO.: SA990928E01
MODEL NO.: GLM-300
FCC ID: YC3GLM300

ACCORDING: FCC Guidelines for Human Exposure
IEEE C95.1

APPLICANT: KEEBOX, Inc

ADDRESS: P.O. Box 2290, Gardena, CA 90247-9998

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

LAB ADDRESS: No. 81-1, Lu Liao Keng, 9th Ling,Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan

RF Exposure Measurement

1. Introduction

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this product is measured in a Fully Anechoic Chamber (FAC) calibrated for antenna measurement in our lab, and also the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

2. RF Exposure Limit

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environmental 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 Exposure				
300-1500	…	…	F/1500	30
1500-100,000	…	…	1.0	30

F = Frequency in MHz

3. 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 MPE value at distance 20cm.

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition, Page 640, Eq. (11-133).

4. EUT Operating condition

The software provided by Manufacturer enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

5. Classification

The antenna of this product, under normal use condition, is at least 20cm away from the body of the user. So, this device is classified as **Mobile Device**.

6. TEST RESULTS

6.1 Antenna Gain

There are six sets of antennas provided to this EUT, please refer to the following table:

Antenna type	Color	Manufacture	Model name	Antenna Gain (dBi) (Included cable loss)	Cable Model	Cable length (mm)	Connector type
Dipole	Black	WANSHIH ELECTRONIC CO., LTD.	WSS002	0	THW0796A	80	I-PEX
			WSS002	-0.6	SHW0795A1	150	I-PEX
	White	WHA YU GROUP	C037-510958-A	1.3	NA	50	I-PEX
			C037-510959-A	1.3	NA	70	I-PEX
			C037-511005-A	1.2	NA	90	I-PEX
PIFA	Gray		C037-511023-A	1.73	NA	85	I-PEX

Above antennas, models: C037-510958-A & C037-511023-A were chosen for final test.

6.2 Output Power Into Antenna & RF Exposure value at distance 20cm:

For Dipole Antenna:

802.11b:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	2412	70.8	0.019	1.0
6	2437	95.5	0.026	1.0
11	2462	97.7	0.026	1.0

802.11g:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	2412	281.8	0.076	1.0
6	2437	257.0	0.069	1.0
11	2462	251.2	0.067	1.0

802.11n (20MHz):

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	2412	263.0	0.071	1.0
6	2437	257.0	0.069	1.0
11	2462	251.2	0.067	1.0

802.11n (40MHz):

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	2422	263.0	0.071	1.0
4	2437	263.0	0.071	1.0
7	2452	229.1	0.061	1.0

For PIFA Antenna:

802.11b:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	2412	70.8	0.021	1.0
6	2437	95.5	0.028	1.0
11	2462	97.7	0.029	1.0

802.11g:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	2412	281.8	0.083	1.0
6	2437	257.0	0.076	1.0
11	2462	251.2	0.074	1.0

802.11n (20MHz):

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	2412	263.0	0.078	1.0
6	2437	257.0	0.076	1.0
11	2462	251.2	0.074	1.0

802.11n (40MHz):

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm^2)	Limit of Power Density (mW/cm^2)
1	2422	263.0	0.078	1.0
4	2437	263.0	0.078	1.0
7	2452	229.1	0.068	1.0

--- END ---