Annex 3. FCC RF Exposure Evaluation

1. Product Information

- Equipment Type   : Satellite Mobile Signal Booster
- Trade name   : Terrestar
- Model No.   : SSPCK-001
- FCC ID   : Z69D01T4JX1
- Product name   : Satellite Smart Phone Car Kit
- Scope of Product   : 2GHz MSS(Mobile-Satellite Service):
  2000–2020 MHz: User-to-Satellite Link;
  2180–2200 MHz: Satellite-to-User Link
- Manufacturer   : AHN Inc.
  1107,IT Premier Tower, 345-50, Gasan-Dong, Geumcheon-Gu, Seoul, Korea

2. Technical Data
Antenna Information
- Antenna Type   : Micro Strip cornical beam Antenna
- Manufacturer   : AHN Inc.
- Gain dBi   : Tx : 3.0 dBi $(30^\circ < f < 60^\circ)$, Rx : LHCP Max. 3.0 dBi $(30^\circ < f < 60^\circ)$

  Beam width : Azimuth 360° , Elevation : $10^\circ \sim 60^\circ$

3. Equipment Type
☐ Fixed or semi-fixed use
☒ Mobile or vehicular mounted use
☐ Portable or handheld use

4. FCC Requirement & Limit
The followings are the FCC requirement for the RF radiation exposure.
- § 1.1307   Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared.
- § 1.1310   Radiofrequency radiation exposure limits
- § 2.1091   Radiofrequency radiation exposure evaluation: mobile devices.
- § 2.1093   Radiofrequency radiation exposure evaluation: portable devices.
- FCC OST/OET Bulletin Number 65 "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation."

UL Korea, Ltd. 33rd FL, Gangnam Finance Center, 737 Yeoksam-dong, Gangnam-gu, Seoul 135-984 Korea
Tel: +82.2.2009.9000, Fax:+82.2.2009.9405   Report Version 1.2 June-06,2007
Only those products bearing the UL Mark should be considered as being covered by UL.

Project Number: 11CA51352   File Number :   TC8516   Page :   2 of 4
Product :   Satellite Smart Phone Car Kit
FCC ID :   Z69D01T4JX1

5. Evaluation Procedure

The procedure used to determine the RF power density was based upon a calculation for determining compliance with the MPE requirements. This calculation is based on the highest EIRP possible from the system, considering maximum power and antenna gain, and considering the limit of uncontrolled exposure limit. The power density level is calculated at a distance of 20 cm. And Minimum distance is also calculated. MPE calculations are calculated under Maximum Power condition in the band.

Calculation Formula

$P_d = PG / (4\pi r^2)$

Where,

P_d= Power Density (mW/cm^2)

P= Power input to the antenna (in appropriate units, e.g., mW)

G= Power gain of the antenna in the direction of interest relative to an isotropic radiator

π=3.1416

r=distance between observation point and centre of the radiator (cm)

6. Limits of RF Exposure

§ 2.1091 Radiofrequency radiation exposure evaluation: mobile devices

(b) A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.

(c) Applications for equipment authorization of mobile and unlicensed transmitting devices subject to routine environmental evaluation must contain a statement confirming compliance with the limits specified in §1.1310 as part of their application.

(d) The limits to be used for evaluation are specified in §1.1310 of this chapter. All unlicensed personal communications service (PCS) devices and unlicensed NII devices shall be subject to the limits for general population/uncontrolled exposure.

(1) For purposes of analyzing mobile transmitting devices under the occupational/controlled criteria specified in §1.1310 of this chapter, time-averaging provisions of the guidelines may be used in conjunction with typical maximum duty factors to determine maximum likely exposure levels.

(2) Time-averaging provisions may not be used in determining typical exposure levels for devices intended for use by consumers in general population/uncontrolled environments as defined in §1.1310 of this chapter. However, "source-based" time-averaging based on an inherent property or duty-cycle of a device is allowed. An example of this is the determination of exposure from a device that uses digital technology such as a time-division multiple-access (TDMA) scheme for transmission of a signal. In general, maximum average power levels must be used to determine compliance.

(3) If appropriate, compliance with exposure guidelines for devices in this section can be accomplished by the use of warning labels and by providing users with information concerning minimum separation distances from transmitting structures and proper installation of antennas.

(4) In some cases, e.g., modular or desktop transmitters, the potential conditions of use of a device may not allow easy classification of that device as either mobile or portable (also see §2.1093). In such cases, applicants are

UL Korea, Ltd. 33rd FL, Gangnam Finance Center, 737 Yeoksam-dong, Gangnam-gu, Seoul 135-984 Korea
Tel: +82.2.2009.9000, Fax:+82.2.2009.9405   Report Version 1.2 June-06,2007
Only those products bearing the UL Mark should be considered as being covered by UL.

responsible for determining minimum distances for compliance for the intended use and installation of the device based on evaluation of either specific absorption rate (SAR), field strength or power density, whichever is most appropriate

The criteria listed in table 1 is used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1310.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f^2)	6
30–300	61.4	0.163	1	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f^2)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1	30

Note 1 : Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Note 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

UL Korea, Ltd. 33rd FL, Gangnam Finance Center, 737 Yeoksam-dong, Gangnam-gu, Seoul 135-984 Korea
Tel: +82.2.2009.9000, Fax:+82.2.2009.9405   Report Version 1.2 June-06,2007
Only those products bearing the UL Mark should be considered as being covered by UL.

Project Number: 11CA51352　　　File Number : TC8516　　　Page : 4 of 4
Product : Satellite Smart Phone Car Kit
FCC ID : Z69D01T4JX1

7. Test Result of MPE Calculation

RF Output Power conducted

Mode	Bandwidth	Modulation Type	RF Output Power(dBm / W)					
			Low		Mid		High	
1	31.25kHz	π/2 BPSK	**35.53**	**3.573**	34.95	3.126	34.24	2.655
2	31.25kHz	π/4 QPSK	**34.84**	**3.048**	34.52	2.831	33.85	2.427
3	62.5 kHz	π/4 QPSK	**35.49**	**3.540**	34.93	3.112	34.24	2.655
4	156.25 kHz	π/4 QPSK	**35.74**	**3.750**	35.17	3.289	34.62	2.897

Power density calculated : For use of Occupational/Controlled Exposures environment

Mode	Bandwidth	Modulation	MPE Limit (mW/cm2)	Power Density (mW/cm2)
1	31.25kHz	π/2 BPSK	5	1.4814
2	31.25kHz	π/4 QPSK	5	1.2099
3	62.5 kHz	π/4 QPSK	5	1.4052
4	156.25 kHz	π/4 QPSK	5	1.4885

Note :
$P_d = PG / (4\pi r^2)$
PG = EIRP, G= 3.0 dBi, π=3.1416, r=20cm

Remarks :

Result of test
Complied with the technical requirement of FCC 47 CFR Part 25 §2.1091 and §1.1310

☒ Complied　　　☐ Failed

UL Korea, Ltd. 33rd FL, Gangnam Finance Center, 737 Yeoksam-dong, Gangnam-gu, Seoul 135-984 Korea
Tel: +82.2.2009.9000, Fax:+82.2.2009.9405　　　　Report Version 1.2 June-06,2007
Only those products bearing the UL Mark should be considered as being covered by UL.