RF Exposure Evaluation For FCC ID: 2AHNW-3010

Refer user manual this device is a GPS tracker, and this device was designed used in Mobile devices that the minimum distance between human's body is **20cm.** Based on the 47CFR 2.1091, this device belongs to Mobile device. The definition of the category as following:

Mobile Derives:

CFR Title 47 §2.1091(b)

(b) For purposes of this section, 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.

FCC KDB 447498 D01 General RF Exposure Guidance v06 Limit

Devices operating in standalone mobile exposure conditions may contain a single transmitter or multiple transmitters that do not transmit simultaneously. A minimum test separation distance ≥ 20 cm is required between the antenna and radiating structures of the device and nearby persons to apply mobile device exposure limits. The distance must be fully supported by the operating and installation configurations of the transmitter and its antenna(s), according to the source-based time-averaged maximum power requirements of § 2.1091(d)(2). In cases where cable losses or other attenuations are applied to determine compliance, the most conservative operating configurations and exposure conditions must be evaluated. The minimum test separation distance required for a device to comply with mobile exposure conditions must be clearly identified in the installation and operating instructions, for all installation and exposure conditions, to enable users and installers to comply with RF exposure requirements. For mobile devices that have the potential to operate in portable device exposure conditions, similar to the configurations described in § 2.1091(d)(4), a KDB inquiry is required to determine the SAR test requirements for demonstrating compliance.

When the categorical exclusion provision of § 2.1091(c) applies, the minimum test separation distance may be estimated, when applicable, by simple calculations according to plane-wave equivalent conditions, to ensure the transmitter and its antenna(s) can operate in manners that meet or exceed the estimated distance. The source-based time-averaged maximum radiated power, according to the maximum antenna gain, must be applied to calculate the field strength and power density required to establish the minimum test separation distance. When the estimated test separation distance becomes overly conservative and does not support compliance, MPE measurement or computational modeling may be used to determine the required minimum separation distance.

According to FCC Part 1.1307, systems operating under the provisions of this section shall be operated in a manner the ensures that the public is not exposed to radio frequency energy level in excess of the commission's guidelines.

Limits for General Population/ Uncontrolled Exposure			
Frequency Range (MHz)	Electric Field Strength(E)(V/m)	Magnetic Field Strength (H)(A/m)	Power Density (S)(mW/cm^2)
0.3-1.34	614	1.63	(100)*
1.34-30	824/f	2.19/f	(180/f2)*
30-300	27.5	0.073	0.2
300-1500			f/1500
1500-100,000			1.0

MPE calculation formula

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = power density

P = output power (mW)

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

R = Separation distance between radiator and human body (cm)

Test Data

GSM 850 Band	Conducted Output Peak Power (dBm)		
Channel	128	190	251
GSM (GMSK, 1-Slot)	**31.98**	31.98	31.95
GPRS (GMSK, 1-Slot)	31.98	31.98	31.95
GPRS (GMSK, 2-Slots)	30.88	30.89	30.86
GPRS (GMSK, 3-Slots)	28.99	28.98	28.93
GPRS (GMSK, 4-Slots)	28.18	28.16	28.17
GSM 1900 Band	Conducted Output Peak Power (dBm)		
Channel	512	661	810
GSM (GMSK, 1-Slot)	**30.69**	30.45	30.19
GPRS (GMSK, 1-Slot)	30.69	30.45	30.19
GPRS (GMSK, 2-Slots)	29.23	28.99	28.75
GPRS (GMSK, 3-Slots)	26.91	26.68	26.45
GPRS (GMSK, 4-Slots)	26.14	25.93	25.69
Note: This report listed the worst case Peak power value, please refer to RF test report for more details.			

Conducted Output Peak Power (dBm)						
WCDMA	Band 2			Band 5		
Channel	9262	9400	9538	4132	4182	4233
RMC 12.2Kbps	21.38	**22.36**	20.99	**25.74**	25.38	25.12
HSDPA Subtest-1	21.50	21.38	20.04	24.77	24.37	24.46
HSDPA Subtest-2	20.38	21.40	20.06	24.77	24.35	23.43
HSDPA Subtest-3	19.92	20.90	19.60	24.24	23.89	23.00
HSDPA Subtest-4	19.89	20.90	19.59	24.21	23.85	22.95
HSUPA Subtest-1	21.37	20.32	20.61	20.34	20.70	20.48
HSUPA Subtest-2	21.45	20.39	20.64	20.35	20.69	20.46
HSUPA Subtest-3	22.43	21.40	21.65	21.36	21.66	21.44
HSUPA Subtest-4	20.88	19.84	20.07	19.82	20.13	19.96
HSUPA Subtest-5	23.35	22.37	22.60	22.31	22.64	22.43
Note: This report listed the worst case peak power value, please refer to RF test report for more details.						

BLUETOOTH				
Mode	GFSK	Π/4-DQPSK	8-DPSK	BLE
Peak Power (dBm)	-1.31	-1.23	**-1.12**	-8.67
Note: This report listed the worst case peak power value, please refer to RF test report for more details.				

Turn-up power

Mode	Tune-up power range (dBm)
GSM 850	31.80-32.30
GPRS850(1 Slot)	31.80-32.30
GPRS850(2 Slots)	30.70-31.40
GPRS850(3 Slots)	28.80-29.50
GPRS850(4 Slots)	28.00-28.50
GSM 1900	30.10-31.10
GPRS1900(1 Slot)	30.10-31.10
GPRS1900(2 Slots)	28.60-29.50
GPRS1900(3 Slots)	26.30-27.40
GPRS1900(4 Slots)	25.60-26.50
WCDMA Band2	20.90-22.80
HSDPA Band2	19.50-21.80
HSUPA Band2	19.70-23.80
WCDMA Band5	25.00-26.30
HSDPA Band5	22.90-25.30
HSUPA Band5	19.70-22.60
BR/EDR	(-3.10)-(-0.60)
BLE	(-10.90)-(-8.10)

Test result

Evolution mode	Maximum peak output power（dBm）	Antenna Gain (typical) (dBi)	Total Power (mw)	Distance (cm)	Limit of Power Density (mW/cm²)	Power Density (mW/cm²)	Verdict
GSM850	32.30	1.6	2454.70	20	0.55	0.49	Pass
GSM1900	31.10	1.3	1737.80	20	1	0.35	Pass
WCDMA Band2	23.80	1.3	323.59	20	1	0.06	Pass
WCDMA Band5	26.30	1.6	616.60	20	0.55	0.12	Pass
Bluetooth	-0.60	-2.87	0.45	20	1	$8.95x10^{-5}$	Pass

Collocated Power Density Calculation

Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of 2G/3G + Bluetooth	Verdict
GSM850	824 MHz ~ 849 MHz	0.89	**0.89**	Pass
Bluetooth	2400MHz ~ 2483.5MHz	$8.95x10^{-5}$		
GSM1900	1850 MHz ~ 1910 MHz	0.35	0.35	Pass
Bluetooth	2400MHz ~ 2483.5MHz	$8.95x10^{-5}$		
WCDMA Band5	824 MHz ~ 849 MHz	0.22	0.22	Pass
Bluetooth	2400MHz ~ 2483.5MHz	$8.95x10^{-5}$		
WCDMA Band2	1850 MHz ~ 1910 MHz	0.06	0.06	Pass
Bluetooth	2400MHz ~ 2483.5MHz	$8.95x10^{-5}$		

Note:

1. Σ(Power Density / Limit): This is a summation of [(power density for each transmitter/ antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for 2G/3G + Bluetooth.
2. Both of the 2G/3G and Bluetooth can transmit simultaneously, the formula of calculated the MPE is CPD1 / LPD1 + CPD2 / LPD2 + ……etc. < 1
   CPD = Calculation power density
   LPD = Limit of power density
3. Both of the 2G network and 3G network can't transmit simultaneously at same time.
4. The worst-case situation is 0.89, which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.
5. The GPS tracker work frequency range used is 824 MHz ~ 849 MHz, 1850 MHz ~ 1910 MHz, 2400 MHz ~ 2483.5 MHz, the result close to the limit by the above formula so, we select 824.2 MHz, 826.4 MHz, 1850.2 MHz, 1880 MHz, 2402 MHz and 2462 MHz, to calculate the exclusion power threshold.
6. More power list please refer to RF test report.