RF Exposure Evaluation For FCC ID: 2AKJB-AMP6500-2

Refer user manual this device is a Unattended Payment Terminal, 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

Band	Maximun Power (dBm)	Maximun Frame-Averaged power (dBm)
GPRS850 1Slots	32.31	23.12
GPRS850 2Slots	32.11	**25.98**
GPRS850 3Slots	30.25	25.83
GPRS850 4Slots	28.76	25.58
EDGE850 1Slots	26.13	16.94
EDGE850 2Slots	25.90	19.77
EDGE850 3Slots	25.71	21.29
EDGE850 4Slots	25.51	22.33
GPRS1900 1Slots	30.40	21.21
GPRS1900 2Slots	30.23	24.10
GPRS1900 3Slots	30.07	25.65
GPRS1900 4Slots	29.94	**26.76**
EDGE1900 1Slots	26.73	17.54
EDGE1900 2Slots	26.39	20.26
EDGE1900 3Slots	26.12	21.70
EDGE1900 4Slots	25.78	22.60

Band	Maximun Power (dBm)
WCDMA Band2	23.29
WCDMA Band4	23.28
WCDMA Band5	22.74
LTE Band2	23.42
LTE Band4	23.36
LTE Band5	22.77
LTE Band12	22.96
LTE Band13	22.87

2.4G WIFI				
Mode	802.11b	802.11g	802.11n20	802.11n40
Maximun Power (dBm)	**14.73**	11.07	9.63	9.85

5.2G WIFI			
Mode	802.11a	802.11n20	802.11n40
Maximun Power (dBm)	**10.12**	9.30	8.61
5.8G WIFI			
Mode	802.11a	802.11n20	802.11n40
Maximun Power (dBm)	**9.21**	8.31	7.51

BLUETOOTH				
Mode	GFSK	π/4-DQPSK	8-DPSK	BLE
Maximun Power (dBm)	5.88	3.48	3.46	-3.59

Turn-up power

Band	Maximun Power Tune-up Limit (dBm)	Maximun Frame-Averaged Power Tune-up Limit (dBm)
GPRS850 1Slots	32.50	23.31
GPRS850 2Slots	32.50	26.37
GPRS850 3Slots	30.50	26.08
GPRS850 4Slots	29.00	25.82
EDGE850 1Slots	26.50	17.31
EDGE850 2Slots	26.00	19.87
EDGE850 3Slots	26.00	21.58
EDGE850 4Slots	26.00	22.82
GPRS1900 1Slots	30.50	21.31
GPRS1900 2Slots	30.50	24.37
GPRS1900 3Slots	30.50	26.08
GPRS1900 4Slots	30.00	26.82
EDGE1900 1Slots	27.00	17.81
EDGE1900 2Slots	26.50	20.37
EDGE1900 3Slots	26.50	22.08
EDGE1900 4Slots	26.00	22.82

Band	Maximun Power Tune-up Limit (dBm)
WCDMA Band2	23.50
WCDMA Band4	23.50
WCDMA Band5	23.50
LTE Band2	23.50
LTE Band4	23.50
LTE Band5	23.50
LTE Band12	23.50
LTE Band13	23.50
WLAN 2.4G 802.11b	15.00
WLAN 2.4G 802.11g	12.00
WLAN 2.4G 802.11n20	11.00
WLAN 2.4G 802.11n40	11.00
WLAN 5.2G 802.11a	11.00
WLAN 5.2G 802.11n20	10.00
WLAN 5.2G 802.11n40	9.00
WLAN 5.8G 802.11a	10.00
WLAN 5.8G 802.11n20	9.00
WLAN 5.8G 802.11n40	8.00
BT 1Mbos	6.00
BT 2Mbos	4.00
BT 3Mbos	4.00
BLE	-3.00

Test result

Evolution mode	Maximum output power (dBm)	Antenna Gain (typical) (dBi)	Total Power (mw)	Distance (cm)	Limit of Power Density (mW/cm²)	Power Density (mW/cm²)	Power Density / Limit	Verdict
GPRS850 2Slots	26.37	-1.9	279.90	20	0.5795	0.056	0.097	Pass
GPRS1900 4Slots	26.82	-2.0	303.39	20	1.0	0.060	0.060	Pass
WCDMA Band2	23.50	-2.4	128.82	20	1.0	0.026	0.026	Pass
WCDMA Band4	23.50	-2.0	141.25	20	1.0	0.028	0.028	Pass
WCDMA Band5	23.50	-1.9	144.54	20	0.5509	0.029	0.053	Pass
LTE Band2	23.50	-2.4	128.82	20	1.0	0.026	0.026	Pass
LTE Band4	23.50	-2.0	141.25	20	1.0	0.028	0.028	Pass
LTE Band5	23.50	-1.9	144.54	20	0.5493	0.029	0.053	Pass
LTE Band12	23.50	-1.5	158.49	20	0.4660	0.032	0.069	Pass
LTE Band13	23.50	-1.2	169.82	20	0.4973	0.034	0.068	Pass
2.4G WIFI	15.00	-0.5	28.18	20	1.0	0.006	0.006	Pass

5.2G WIFI	11.00	0	12.59	20	1.0	0.003	0.003	Pass
5.8G WIFI	10.00	0	10.00	20	1.0	0.002	0.002	Pass
Bluetooth	6.00	-0.5	3.55	20	1.0	0.001	0.001	Pass

Collocated Power Density Calculation

Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of 2G/3G/4G+2.4G WIFI	Verdict
GSM 850	824 ~ 849	0.097	**0.103**	Pass
2.4G WIFI	2400 ~ 2483.5	0.006		Pass

Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of 2G/3G/4G+5G WIFI	Verdict
GSM 850	824 ~ 849	0.097	0.100	Pass
5.2G WIFI	5150 ~ 5250	0.003		Pass

Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of 2G/3G/4G+Bluetooth	Verdict
GSM 850	824 ~ 849	0.097	0.098	Pass
Bluetooth	2400 ~ 2483.5	0.001		Pass

Note:

1. The Unattended Payment Terminal work frequency range used is GPRS 850: 824 MHz ~ 849 MHz, GPRS 1900: 1850 MHz ~ 1910 MHz, WCDMA Band 2: 1850 MHz ~ 1910 MHz , WCDMA Band 4: 1710 MHz ~ 1755 MHz, WCDMA Band 5: 824 MHz ~ 849 MHz, LTE Band 2: 1850 MHz ~ 1910 MHz,
   LTE Band 4: 1710 MHz ~ 1755 MHz, LTE Band 5: 824 MHz ~ 849 MHz, LTE Band 12: 699 MHz ~ 716 MHz, LTE Band 13: 777 MHz ~ 787 MHz, 2400 MHz ~ 2483.5 MHz, 5150 MHz ~ 5250 MHz, 5725 MHz ~ 5850 MHz, the result close to the limit by the above formula.
2. 2G&3G&4G share the same antenna and can't transmit simultaneously.
3. The Bluetooth and WLAN share the same antenna, can't transmitting together.
4. Σ(Power Density / Limit): This is a summation of [(power density for each transmitter/ antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for GSM/WCDMA/LTE+2.4GWIFI, GSM/WCDMA/LTE+5GWIF, GSM/WCDMA/LTE+Bluetooth .
5. The Bluetooth, 2.4G WLAN or 5G WLAN can transmit simultaneously with each WWAN, the formula of calculated the MPE is
   CPD1 / LPD1 + CPD2 / LPD2 + ……etc. < 1
   CPD = Calculation power density

6. The worst-case situation is 0.103, which is less than “1”. This confirmed that the device comply with FCC 1.1310 MPE limit.

Conclusion:

RF exposure Evaluation Results: **Compliance**