RF Exposure Evaluation For FCC ID: 2AKWS-ASERIES

Refer user manual this device is a Smart Projector, 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)

Peak Power Test Data

BLUETOOTH				
Mode	BR/EDR			BLE
	GFSK	Π/4-DQPSK	8-DPSK	GFSK
Peak power (dBm)	1.43	1.55	-1.22	**7.63**
2.4G WIFI				
Mode	802.11b	802.11g	802.11n-20	
Peak power (dBm)	15.54	**19.23**	18.00	
5G WIFI				
Band (MHz)	Band I (5150 – 5250)	Band IV (5725 – 5850)		
Mode	802.11a	802.11a		
Conducted power (dBm)	**19.21**	17.98		
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)
GFSK	(-6.20)-1.60
Π/4-DQPSK	(-6.60)-1.70
8-DPSK	(-1.80)-(-1.00)
BLE	(-1.70)-7.80
802.11b	14.40-15.70

Mode	Tune-up power range (dBm)
802.11g	18.90-19.50
802.11n-20	17.50-18.20
Band I (5150 – 5250)	18.90-19.50
Band IV (5725 – 5850)	16.90-18.20

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
Bluetooth	7.80	0	6.03	20	1	0.005	Pass
802.11g	19.50	0	89.13	20	1	0.018	Pass
Band I (5150 – 5250)	19.50	0	89.13	20	1	0.018	Pass
Band IV (5725 – 5850)	18.20	0	66.07	20	1	0.013	Pass

Note:

1. Bluetooth, 2.4GWLAN and 5G WLAN share the same antenna and can't transmit simultaneously.
2. The Smart Projetor work frequency range used is 2400 MHz ~ 2483.5 MHz, 5150 MHz ~ 5250 MHz, 5725 MHz ~ 5850, the result close to the limit by the above formula so, we select 2402MHz, 2462MHz, 5240MHz to calculate the exclusion power threshold.
3. More power list please refer to RF test report.