RF Exposure Evaluation For FCC ID: 2AHMN-TETHYS

Refer user manual this device is a Tethys, 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)

Module1 (ANT0 + ANT1) Test Data

802.11P			
Mode	BPSK		
Channel	Low	Middle	High
Channel No.	172	178	184
Center Frequency (MHz)	5860	5890	5920
EIRP (dBm)	31.98	31.97	32.06
Mode	64-QAM		
Channel	Low	Middle	High
Channel No.	172	178	184
Center Frequency (MHz)	5860	5890	5920
EIRP (dBm)	32.03	**32.10**	31.73

Note:

1. This report listed the worst case EIRP power value, please refer to RF test report for more details.
2. The module1 has two antenna of ANT0 and ANT1, total power of two antennas is listed in this report.

Module2 (ANT2 + ANT3) Test Data

802.11P			
Mode	BPSK		
Channel	Low	Middle	High
Channel No.	172	178	184
Center Frequency (MHz)	5860	5890	5920
EIRP (dBm)	32.16	32.00	31.91
Mode	64-QAM		
Channel	Low	Middle	High
Channel No.	172	178	184
Center Frequency (MHz)	5860	5890	5920
EIRP (dBm)	32.07	32.00	**32.72**

Note:

1. This report listed the worst case EIRP power value, please refer to RF test report for more details.
2. The module2 has two antennas of ANT2 and ANT3, total power of two antennas is listed in this report.

Normal Mode RF Power Range

Band	Modulation	Channel No.	Center Frequency (MHz)	Range(dBm)
802.11P **(Module1)**	BPSK	172	5860	31.90-32.10
		178	5890	31.85-32.05
		180	5900	22.15-22.35
		182	5910	22.15-22.35
		184	5920	31.95-32.15
802.11P **(Module1)**	64-QAM	172	5860	31.95-32.15
		178	5890	32.00-32.20
		180	5900	22.05-22.30
		182	5910	21.95-22.15
		184	5920	31.60-31.85

Band	Modulation	Channel No.	Center Frequency (MHz)	Range(dBm)
802.11P **(Module2)**	BPSK	172	5860	32.05-32.25
		178	5890	31.90-32.10
		180	5900	31.95-22.15
		182	5910	22.45-22.65
		184	5920	31.80-32.00
802.11P **(Module2)**	64-QAM	172	5860	31.95-32.15
		178	5890	31.90-32.10
		180	5900	21.95-22.15
		182	5910	21.95-22.15

		184	5920	32.60-32.85

Test result

Evolution mode	Maximum RF Output power（dBm）	Antenna Gain (typical) (dBi)	Total Power (mw)	Distance (cm)	Limit of Power Density (mW/cm²)	Power Density (mW/cm²)	Verdict
802.11P **(Module1)**	32.20	5	1659.59	20	1	0.330	Pass
802.11P **(Module2)**	32.85	5	1927.52	20	1	0.383	Pass
Note: The module1 and module2 can't simultaneous transmission.							

Note:

1. The Tethys work frequency range used is 5850 MHz ~ 5925 MHz, the result close to the limit by the above formula so, we select 5890MHz and 5920MHz to calculate the exclusion power threshold.
2. More power list please refer to RF test report.