

MPE Report

Applicant : Rajant Corporation
Product Name : Radio Module
Trade Name : VIZMONET
Model Number : RJ-1704
Applicable Standard : 47 CFR § 2.1091
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Revision History

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1. General Information

1.1 Reference Applicable Standard

Standard	Description	Version
IEEE C95.1	American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 300 KHz to 100 GHz, New York.	1992
47 CFR Part §2.1091	Radiofrequency radiation exposure evaluation: mobile devices.	-
47 CFR Part §1.1310	Radiofrequency radiation exposure limits.	-
KDB 447498 D04	RF exposure procedures and equipment authorization policies for mobile and portable devices	v01

2. Description of Equipment under Test (EUT)

Applicant	Rajant Corporation 200 Chesterfield Parkway, Malvern, Pennsylvania 19355-3258, United States www.rajant.com
Manufacturer	Vizmonet Pte Ltd 21, Woodlands Close, #02-07, Primz Biz Hub, Singapore 737 854 www.vizmonet.com
Product Name	Radio Module
Trade Name	VIZMONET
Model Number	RJ-1704
FCC ID	VJA-RJ1704
Frequency Range	WLAN 4.9 GHz Band : 4942.5 - 4978.5 MHz WLAN 5.2 GHz Band : 5180 - 5320 MHz WLAN 5.6 GHz Band : 5500 - 5720 MHz WLAN 5.8 GHz Band : 5745 - 5825 MHz
Supported Modulations	WLAN 4.9 GHz : 802.11a / n HT20
	WLAN 5 GHz : 802.11a / n HT20 / HT40

Note:

The above information of DUT was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

Antenna Information				
Model	Type	Frequency	Max. Gain (dBi)	Directional Gain (dBi)
FP4959-22DP	External type (Directional Panel)	4.8~5.0 GHz	22	25.01
KMA-4800-6-NM	External type (Omni-directional)	4.8~5.0 GHz	6	9.01
KMA-5250-7-NM		5150~5250 MHz	7	10.01
		5250~5350 MHz	7	10.01
KMA-5550-6-NM		5470~5725 MHz	6	9.01
KMA-5800-6-NM		5725~5900 MHz	6	9.01
Antenna Diversity				
WLAN 4.9 GHz : 1TX (Diversity) / 2TX (MIMO) IEEE 802.11a : 1TX (Diversity) / 2TX (STBC) IEEE 802.11n 5 GHz 20 MHz : 1TX (Diversity) / 2TX (STBC) IEEE 802.11n 5 GHz 40 MHz : 1TX (Diversity) / 2TX (STBC)				

3. RF Exposure Limit

For devices that operate at larger distances from persons, where there are minimal RF coupling interactions between a device and the user or nearby persons, RF exposure compliance using maximum permissible exposure (MPE) limits is applied. The limits for MPE is listed as below:

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)	Averaging Time E ² , H ² or S (minutes)
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 / 1,500	30
1,500-100,000	-	-	1.0	30
Limits for Occupational / Controlled Exposure				
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1,842 / f	4.89 / f	(900 / f ²)*	6
30-300	61.4	0.163	1.0	6
300-1,500	-	-	F / 300	6
1,500-100,000	-	-	5	6

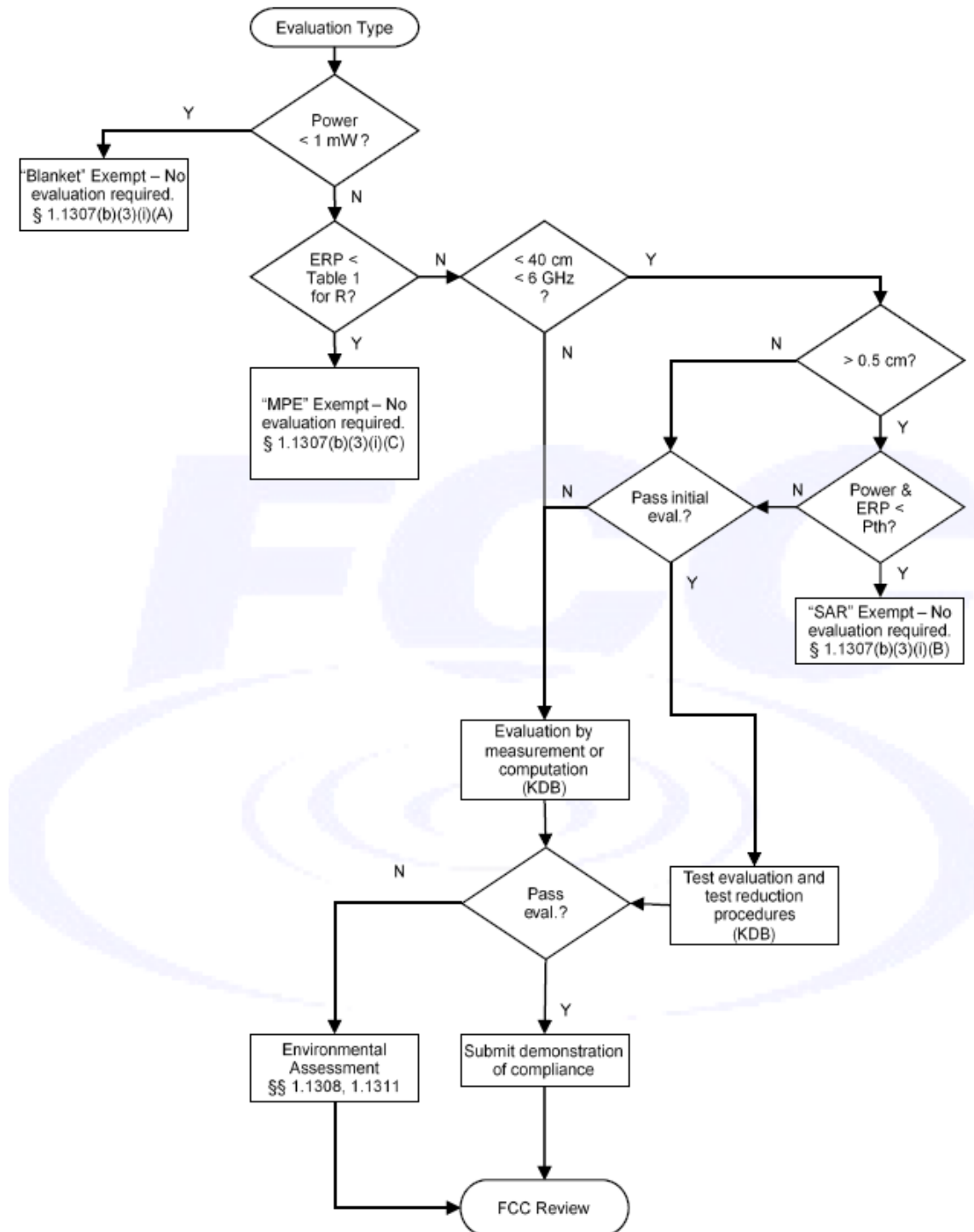
f = frequency in MHz. * = Plane-wave equivalent power density.

4. RF Exposure Assessment

4.1 Exemption Evaluation

Exemption evaluation was performed according to the appendix A and B in KDB447498 D04.

The General Sequence for Determination of Procedure demonstrated in Figure A.1 of KDB447498 D04 was applied.



4.2 Human Exposure Assessment

Due to the design and installation of this product, it is not possible to conduct SAR evaluation. This is because client either manufactures or supplies the antenna(s) that will be used in the installation of this product. Therefore, this product will be evaluated as a mobile device per 47 CFR § 1.1310 titled "Radiofrequency radiation exposure limits", generally referred to as MPE limits.

In 47 CFR § 2.1091, paragraph (b) defines a mobile device 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 cm is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons." This product is intended to be installed into a vehicle such that the unit is physically secured at one location. In the installation guide supplied with the product, Client has made the following statement: "IMPORTANT: To meet the FCC's RF Exposure Guidelines, the antenna should be installed so there is at least 68 cm of separation between the body of the user and nearby persons and the PCTEL antenna, and at least 26 cm of separation between the body of the user and nearby persons and the RAJANT antenna".

Exposure evaluation

$$S_{eirp} = \frac{EIRP}{4\pi d^2} = \frac{PG}{4\pi d^2} (W / m^2)$$

Where

S= Power density in W/m²

EIRP = Equivalent Isotropic Radiated Power in W

P = power of transmitter;

G = the antenna gain;

d = the distance between antennas and evaluation point in m

Total Exposure Ratio (TER):

According to KDB447498, either SAR-based or MPE-based exemption may be considered for test exemption for fixed, mobile, or portable device exposure conditions; therefore, the contributions from each exemption in conjunction with the measured SAR (*Evaluated_k* term) shall be used to determine exemption for simultaneous transmission according to the following formula [repeated from § 1.1307(b)(3)(ii)(B)].

The sum of the ratios of the applicable terms for SAR-based, MPE-based and measured SAR or MPE shall be less than 1, to determine simultaneous transmission exposure compliance.

$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$	
a	number of fixed, mobile, or portable RF sources claiming exemption using the § 1.1307(b)(3)(i)(B) formula for P_{th} , including existing exempt transmitters and those being added.
b	number of fixed, mobile, or portable RF sources claiming exemption using the applicable § 1.1307(b)(3)(i)(C) Table 1 formula for Threshold ERP, including existing exempt transmitters and those being added.
c	number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance.
P_i	the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).
$P_{th,i}$	the exemption threshold power (P_{th}) according to the § 1.1307(b)(3)(i)(B) formula for fixed, mobile, or portable RF source i .
ERP_j	the available maximum time-averaged power or the ERP, whichever is greater, of fixed, mobile, or portable RF source j .
$ERP_{th,j}$	exemption threshold ERP for fixed, mobile, or portable RF source j , at a distance of at least $\lambda/2\pi$, according to the applicable § 1.1307(b)(3)(i)(C) Table 1 formula at the location in question.
<i>Evaluated_k</i>	the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation.
<i>Exposure Limit_k</i>	either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable sources, as applicable

5. Maximum Tune-up Power

Antenna Trade Name	Operate Band	Frequency (MHz)	ANT 0	ANT 1	MIMO
PCTEL	4.9 GHz	4942.5 - 4987.5	19	19.5	17
RAJANT	4.9 GHz	4942.5 - 4987.5	26	26.5	29.5
RAJANT	5.2 GHz	5150 - 5250	20	20.5	21
RAJANT	5.3 GHz	5250 - 5350	22.5	23	22
RAJANT	5.6 GHz	5470 - 5725	23	23.5	23
RAJANT	5.8 GHz	5725 - 5850	26	27	28

6. Result

Band	Frequency (MHz)	Distance (cm) [R]	Tune-up Power (dBm) [P]	ANT Gain (dBi)	Numeric Gain [G]	Duty Cycle	Power with Duty cycle (mW) [P]x[G]	Power Density (mW/cm ²) [S]	Standalone Limit (mW/cm ²)	Antenna	Antenna Trade Name
4.9 GHz	4942.5 - 4987.5	68	19.00	25.01	316.96	1	25177.03	0.43	1.00	ANT 0	PCTEL
4.9 GHz	4942.5 - 4987.5	26	26.00	9.01	7.96	1	3168.93	0.37	1.00	ANT 0	RAJANT
5.2 GHz	5150 - 5250	26	20.00	10.01	10.02	1	1002.00	0.12	1.00	ANT 0	RAJANT
5.3 GHz	5250 - 5350	26	22.50	10.01	10.02	1	1781.84	0.21	1.00	ANT 0	RAJANT
5.6 GHz	5470 - 5725	26	23.00	9.01	7.96	1	1588.23	0.19	1.00	ANT 0	RAJANT
5.8 GHz	5725 - 5850	26	26.00	9.01	7.96	1	3168.93	0.37	1.00	ANT 0	RAJANT
4.9 GHz	4942.5 - 4987.5	68	19.50	25.01	316.96	1	28249.09	0.49	1.00	ANT 1	PCTEL
4.9 GHz	4942.5 - 4987.5	26	26.50	9.01	7.96	1	3555.60	0.42	1.00	ANT 1	RAJANT
5.2 GHz	5150 - 5250	26	20.50	10.01	10.02	1	1124.26	0.13	1.00	ANT 1	RAJANT
5.3 GHz	5250 - 5350	26	23.00	10.01	10.02	1	1999.25	0.24	1.00	ANT 1	RAJANT
5.6 GHz	5470 - 5725	26	23.50	9.01	7.96	1	1782.02	0.21	1.00	ANT 1	RAJANT
5.8 GHz	5725 - 5850	26	27.00	9.01	7.96	1	3989.45	0.47	1.00	ANT 1	RAJANT

Note:

- According to user manual, separation distance is 68 cm for PCTEL Antenna and 26 cm for RAJANT Antenna.
- The maximum power and directional gain were applied to evaluate MPE for multiple antennas transmitting. If all transmit signals are completely uncorrelated, directional gain = Gant.
- The Numeric Gain calculated by $10^{(\text{ant. Gain(dBi)} / 10)}$.

Simultaneous Transmitting :

Total MPE : 0.92 mW/cm²

TER: 0.92 < 1

7. Conclusion

The result shows that this device is compliance with the exposure limits in 47 CFR §1.1310.

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