

MPE Report

Applicant : Rajant Corporation

Product Name : BreadCrumb ES1

Trade Name : VIZMONET

Model Number : ES1-5050CS

Applicable Standard : 47 CFR § 2.1091

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Revision History

Rev.	Issued Date	Revisions	Revised By
00	May 06, 2022	Initial Issue	Emma Chao
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1. General Information

1.1 Reference Applicable Standard

Standard	Description	Version
47 CFR Part §1.1310	Radiofrequency radiation exposure limits.	-
47 CFR Part §2.1091	Radiofrequency radiation exposure evaluation: mobile devices.	-
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
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
Product Name	BreadCrumb ES1
Trade Name	VIZMONET
Model Number	ES1-5050CS
FCC ID	VJA-ES15050CS
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)
KMA-4800-6-NM	External type (Omni-directional)	4.8~5.0 GHz	6	9.01
KMA-5250-7-NM	External type (Omni-directional)	5150~5250 MHz	7	10.01
		5250~5350 MHz	7	10.01
		5470~5725 MHz	6	9.01
		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)			

Note:

Module RJ-2002 and RJ-1705 use the same antenna model.

3. 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 32 cm of separation between the body of the user and nearby persons and the antenna". Based on the installation of the transceiver and the antenna, the transmitters radiating structure is more than 32 cm from the user. Thus, this product is a "mobile device" as defined in section § 2.1091 paragraph (b).

Exposure evaluation

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

Where

S: is the input power (W);

G: is the antenna gain;

d : is the distance between antennas and evaluation point (m).

4. Power Density Limit – RF Exposure Evaluation

In 47 CFR § 1.1310, use of the device as based upon the user's awareness and ability to exercise control over human exposure. The two categories defined are Occupational / Controlled Exposure and General Population / Uncontrolled.

These two categories are defined as follow:

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

5. Maximum Tune-up Power

Module: RJ-2002

Operate Band	Frequency (MHz)	ANT 0	ANT 1	MIMO
4.9 GHz	4942.5 - 4987.5	27	26.5	29
5.2 GHz	5150 - 5250	23	23.5	23
5.3 GHz	5250 - 5350	21.5	22	22.5
5.6 GHz	5470 - 5725	22	22.5	22.5
5.8 GHz	5725 - 5850	26.5	27	28.5

Module: RJ-1705

Operate Band	Frequency (MHz)	ANT 0	ANT 1	MIMO
4.9 GHz	4942.5 - 4987.5	24.5	24.5	27
5.2 GHz	5150 - 5250	19.5	19.5	22
5.3 GHz	5250 - 5350	20.5	20.5	20.5
5.6 GHz	5470 - 5725	21	21	21.5
5.8 GHz	5725 - 5850	24.5	24	26.5

6. Test 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
4.9 GHz	4942.5 - 4987.5	32.0	27.00	9.01	7.96	1	3989.45	0.31	1.00	RJ-2002 - ANT 0
5.2 GHz	5150 - 5250	32.0	23.00	10.01	10.02	1	1999.25	0.16	1.00	RJ-2002 - ANT 0
5.3 GHz	5250 - 5350	32.0	21.50	10.01	10.02	1	1415.36	0.11	1.00	RJ-2002 - ANT 0
5.6 GHz	5470 - 5725	32.0	22.00	9.01	7.96	1	1261.57	0.10	1.00	RJ-2002 - ANT 0
5.8 GHz	5725 - 5850	32.0	26.50	9.01	7.96	1	3555.60	0.28	1.00	RJ-2002 - ANT 0
4.9 GHz	4942.5 - 4987.5	32.0	26.50	9.01	7.96	1	3555.60	0.28	1.00	RJ-2002 - ANT 1
5.2 GHz	5150 - 5250	32.0	23.50	10.01	10.02	1	2243.20	0.17	1.00	RJ-2002 - ANT 1
5.3 GHz	5250 - 5350	32.0	22.00	10.01	10.02	1	1588.06	0.12	1.00	RJ-2002 - ANT 1
5.6 GHz	5470 - 5725	32.0	22.50	9.01	7.96	1	1415.51	0.11	1.00	RJ-2002 - ANT 1
5.8 GHz	5725 - 5850	32.0	27.00	9.01	7.96	1	3989.45	0.31	1.00	RJ-2002 - ANT 1
4.9 GHz	4942.5 - 4987.5	32.0	24.50	9.01	7.96	1	2243.43	0.17	1.00	RJ-1705 - ANT 0
5.2 GHz	5150 - 5250	32.0	19.50	10.01	10.02	1	893.03	0.07	1.00	RJ-1705 - ANT 0
5.3 GHz	5250 - 5350	32.0	20.50	10.01	10.02	1	1124.26	0.09	1.00	RJ-1705 - ANT 0
5.6 GHz	5470 - 5725	32.0	21.00	9.01	7.96	1	1002.10	0.08	1.00	RJ-1705 - ANT 0
5.8 GHz	5725 - 5850	32.0	24.50	9.01	7.96	1	2243.43	0.17	1.00	RJ-1705 - ANT 0
4.9 GHz	4942.5 - 4987.5	32.0	24.50	9.01	7.96	1	2243.43	0.17	1.00	RJ-1705 - ANT 1
5.2 GHz	5150 - 5250	32.0	19.50	10.01	10.02	1	893.03	0.07	1.00	RJ-1705 - ANT 1
5.3 GHz	5250 - 5350	32.0	20.50	10.01	10.02	1	1124.26	0.09	1.00	RJ-1705 - ANT 1
5.6 GHz	5470 - 5725	32.0	21.00	9.01	7.96	1	1002.10	0.08	1.00	RJ-1705 - ANT 1
5.8 GHz	5725 - 5850	32.0	24.00	9.01	7.96	1	1999.46	0.16	1.00	RJ-1705 - ANT 1

Note:

1. The maximum power and directional gain were applied to evaluate multiple antennas transmitting MPE.
2. The Numeric Gain calculated by $10^{(\text{ant. Gain(dBi)} / 10)}$.
3. The simultaneous transmission of this device only operates in MIMO mode.

Simultaneous Transmission :	Total MPE :	TER:
4.9 GHz (RJ-2002) + 5 GHz (RJ-1705):	0.92 mW/cm ²	0.92 <1
4.9 GHz (RJ-1705) + 5 GHz (RJ-2002):	0.93 mW/cm ²	0.93 <1

7. Conclusion

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

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