

FCC RF EXPOSURE REPORT

FCC ID: G95OWM7111

Project No. : 2406C089B
Equipment : IoT gateway
Brand Name : Vantiva
Test Model : OWM7111IOT
Series Model : OWM7111IOT1
Applicant : Vantiva USA LLC
Address : 4855 Peachtree Industrial Blvd. Suite 200 Norcross, Georgia 30092
Manufacturer : Vantiva USA LLC
Address : 4855 Peachtree Industrial Blvd. Suite 200 Norcross, Georgia 30092
Factory : FUHONG PRECISION COMPONENT (BAC GIANG) COMPANY LIMITED
Address : Dinh Tram Industrial Zone.Nenh Ward Viet Yen Town.Bac Giang Province. Vietnam
Date of Receipt : Jun. 25, 2024
Date of Test : Jun. 25, 2024 ~ Aug. 28, 2024
Issued Date : Sep. 27, 2024
Report Version : R00
Test Sample : Engineering Sample No.: DG2024081298 for LE & Zigbee & Sub 1G, DG2024062515 for WiFi 2.4G/5G.
Standard(s) : FCC Guidelines for Human Exposure IEEE C95.1 & FCC Part 2.1091 FCC Title 47 Part 2.1091 & KDB 447498 D01 v06

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

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REPORT ISSUED HISTORY

Report No.	Version	Description	Issued Date	Note
BTL-FCCP-9-2406C08B	R00	Original Report.	Sep. 27, 2024	Valid

1. MPE CALCULATION METHOD

Calculation Method of RF Safety Distance:

$$S = \frac{PG}{4\pi r^2} = \frac{EIRP}{4\pi r^2}$$

where:

S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

2. ANTENNA SPECIFICATION

For LE:

Ant.	Brand	IPN	Antenna Type	Connector	Gain (dBi)
1	Vantiva	6338357D	PCB	N/A	5.9

Note: The antenna gain is provided by the manufacturer.

For Zigbee:

Ant.	Brand	IPN	Antenna Type	Connector	Gain (dBi)
1	Vantiva	6338356D	PCB	N/A	6.7

Note: The antenna gain is provided by the manufacturer.

For Thread:

Ant.	Brand	IPN	Antenna Type	Connector	Gain (dBi)
1	Vantiva	6338355D	PCB	N/A	6

Note: The antenna gain is provided by the manufacturer.

For Sub 1G (HL):

Ant.	Brand	IPN	Antenna Type	Connector	Gain (dBi)
1	Vantiva	6341773C	PCB	N/A	2.40

Note: The antenna gain is provided by the manufacturer.

For Sub 1G (LR1 500Kbps / LR1 125Kbps):

Ant.	Brand	IPN	Antenna Type	Connector	Gain (dBi)
1	Vantiva	6338358D	PCB	N/A	2.40

Note: The antenna gain is provided by the manufacturer.

For Sub 1G (LR2):

Ant.	Brand	IPN	Antenna Type	Connector	Gain (dBi)
1	Vantiva	6341772C	PCB	N/A	1.70

Note: The antenna gain is provided by the manufacturer.

For WiFi 2.4G:

Ant.	Brand	IPN	Antenna Type	Connector	Gain (dBi)
1	Vantiva	6338351C	PCB	IPEX	5.4
2	Vantiva	6338352C	PCB	IPEX	6.1

Note:

1) For CDD: Directional gain=4.82 dBi.

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

where

Each antenna is driven by no more than one spatial stream;

 N_{SS} = the number of independent spatial streams of data;

 N_{ANT} = the total number of antennas

 $g_{j,k} = 10^{G_k / 20}$ if the k th antenna is being fed by spatial stream j , or zero if it is not;

 G_k is the gain in dBi of the k th antenna.

 2) For TXBF: Directional gain=6.28 dBi. So, the output power limit is $30 - (6.28 - 6) = 29.72$

3) The antenna gain and beamforming gain are provided by the manufacturer.

For WiFi 5G:

Ant.	Brand	IPN	Antenna Type	Connector	Gain (dBi)	Note
1	Vantiva	6338351C	PCB	IPEX	7.00	UNII-1
2	Vantiva	6338352C	PCB	IPEX	7.50	
1	Vantiva	6338351C	PCB	IPEX	7.40	UNII-3
2	Vantiva	6338352C	PCB	IPEX	8.90	

Note:

 1) For CDD: UNII-1 Directional gain=6.25 dBi; So, the UNII-1 output power limit is $30 - (6.25 - 6) = 29.75$, the power spectral density limit is $17 - (6.25 - 6) = 16.75$.

 UNII-3 Directional gain=6.38 dBi; So, the UNII-3 output power limit is $30 - (6.38 - 6) = 29.62$, the power spectral density limit is $30 - (6.38 - 6) = 29.62$.

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

where

Each antenna is driven by no more than one spatial stream;

 N_{SS} = the number of independent spatial streams of data;

 N_{ANT} = the total number of antennas

 $g_{j,k} = 10^{G_k / 20}$ if the k th antenna is being fed by spatial stream j , or zero if it is not;

 G_k is the gain in dBi of the k th antenna.

 2) For TXBF: UNII-1 Directional gain=6.30 dBi. So, the output power limit is $30 - (6.30 - 6) = 29.70$.

 UNII-3 Directional gain=6.83 dBi. So, the output power limit is $30 - (6.83 - 6) = 29.17$.

3) No TXBF: The maximum directional gain at any elevation angle above 30 degrees as measured from the horizon is -4.96 dBi.

4) For TX BF: The maximum directional gain at any elevation angle above 30 degrees as measured from the horizon is -3.21 dBi.

3. TABLE FOR ANTENNA CONFIGURATION

For WiFi 2.4G:

For Non Beamforming:

Operating Mode	TX Mode	2TX
IEEE 802.11b		V(Ant. 1 + Ant. 2)
IEEE 802.11g		V(Ant. 1 + Ant. 2)
IEEE 802.11n(HT20)		V(Ant. 1 + Ant. 2)
IEEE 802.11n(HT40)		V(Ant. 1 + Ant. 2)
IEEE 802.11ax(HE20)		V(Ant. 1 + Ant. 2)
IEEE 802.11ax(HE40)		V(Ant. 1 + Ant. 2)

For Beamforming:

Operating Mode	TX Mode	2TX
IEEE 802.11n(HT20)		V(Ant. 1 + Ant. 2)
IEEE 802.11n(HT40)		V(Ant. 1 + Ant. 2)
IEEE 802.11ax(HE20)		V(Ant. 1 + Ant. 2)
IEEE 802.11ax(HE40)		V(Ant. 1 + Ant. 2)

For WiFi 5G:

For Non Beamforming:

Operating Mode	TX Mode	2TX
IEEE 802.11a		V (Ant. 1 + Ant. 2)
IEEE 802.11n(HT20)		V (Ant. 1 + Ant. 2)
IEEE 802.11n(HT40)		V (Ant. 1 + Ant. 2)
IEEE 802.11ac(VHT20)		V (Ant. 1 + Ant. 2)
IEEE 802.11ac(VHT40)		V (Ant. 1 + Ant. 2)
IEEE 802.11ac(VHT80)		V (Ant. 1 + Ant. 2)
IEEE 802.11ax(HE20)		V (Ant. 1 + Ant. 2)
IEEE 802.11ax(HE40)		V (Ant. 1 + Ant. 2)
IEEE 802.11ax(HE80)		V (Ant. 1 + Ant. 2)

For Beamforming:

Operating Mode	TX Mode	2TX
IEEE 802.11n(HT20)		V (Ant. 1 + Ant. 2)
IEEE 802.11n(HT40)		V (Ant. 1 + Ant. 2)
IEEE 802.11ac(VHT20)		V (Ant. 1 + Ant. 2)
IEEE 802.11ac(VHT40)		V (Ant. 1 + Ant. 2)
IEEE 802.11ac(VHT80)		V (Ant. 1 + Ant. 2)
IEEE 802.11ax(HE20)		V (Ant. 1 + Ant. 2)
IEEE 802.11ax(HE40)		V (Ant. 1 + Ant. 2)
IEEE 802.11ax(HE80)		V (Ant. 1 + Ant. 2)

4. CALCULATED RESULT

For 2.4GHz Non Beamforming:

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
4.82	3.0339	29.27	845.2788	0.22687	1	Complies

For 2.4GHz Beamforming:

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
6.28	4.2462	27.91	618.0164	0.23215	1	Complies

For 5GHz UNII-1 Non Beamforming:

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
6.25	4.2170	25.83	382.8247	0.14281	1	Complies

For 5GHz UNII-1 Beamforming:

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
6.30	4.2658	24.16	260.6154	0.09835	1	Complies

For 5GHz UNII-3 Non Beamforming:

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
6.38	4.3451	26.34	430.5266	0.16549	1	Complies

For 5GHz UNII-3 Beamforming:

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
6.83	4.8195	26.11	408.3194	0.17409	1	Complies

For LE:

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
5.9	3.8905	19.93	98.4011	0.03387	1	Complies

For Sub 1G (LR1):

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
2.4	1.7378	21.53	142.2329	0.02187	1	Complies

For Sub 1G (LR2):

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
1.7	1.4791	27	501.1872	0.06558	1	Complies

For Sub 1G (HL):

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
2.4	1.7378	21.02	126.4736	0.01944	1	Complies

For Zigbee:

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
6.7	4.6774	19.29	84.9180	0.03514	1	Complies

For Thread:

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Output Power (dBm)	Max. Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
6	3.9811	19.29	84.9180	0.02991	1	Complies

For the max simultaneous transmission MPE:

Ratio						Total	Limit of Ratio	Test Result
2.4GHz	5GHz	LR1	LR2	HL	Zigbee			
0.23215	0.17409	0.02187	0.06558	0.01944	0.03514	0.54827	1	Complies

Note:

- (1) The calculated distance is 30 cm.
- (2) Ratio=Power Density (S) (mW/cm²)/Limit of Power Density (S) (mW/cm²)

End of Test Report