RF Exposure Evaluation Report

APPLICANT	:	**Vantiva USA LLC**
EQUIPMENT	:	**DOCSIS 3.1**
BRAND NAME	:	**Vantiva**
MODEL NAME	:	**CGM4981COM2**
FCC ID	:	**G954981X2**
STANDARD	:	**47 CFR Part 2.1091**

The product evaluation date was started from Dec. 06, 2023 and completed on Dec. 06, 2023. We, Sporton International Inc. (Kunshan), would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091 and FCC KDB 447498 D01 v06, and pass the limit. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Si Zhang

Approved by: Si Zhang

ACCREDITED Cert #5145.02

Sporton International Inc. (Kunshan)
No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China

Table of Contents

Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA391301	Rev. 01	Initial issue of report.	Dec. 15, 2023

1. Administration Data

1.1. Testing Laboratory

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Testing Laboratory			
Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	SAR01-KS	CN1257	314309

Applicant	
Company Name	Vantiva USA LLC
Address	4855 Peachtree Industrial Blvd. Suite 200 Norcross, Georgia 30092

Manufacturer	
Company Name	Vantiva USA LLC
Address	4855 Peachtree Industrial Blvd. Suite 200 Norcross, Georgia 30092

2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	DOCSIS 3.1
Brand Name	Vantiva
Model Name	CGM4981COM2
FCC ID	G954981X2
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz WLAN 6GHz U-NII-5: 5925 MHz ~ 6425 MHz WLAN 6GHz U-NII-6: 6425 MHz ~ 6525 MHz WLAN 6GHz U-NII-7: 6525 MHz ~ 6875 MHz WLAN 6GHz U-NII-8: 6875 MHz ~ 7125 MHz Bluetooth: 2402 MHz ~ 2480 MHz ZigBee: 2405 MHz ~ 2480 MHz
Mode	WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 2.4GHz 802.11ac VHT20/VHT40 WLAN 2.4GHz 802.11ax HE20/HE40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80/VHT160 WLAN 5GHz 802.11ax HE20/HE40/HE80/HE160 WLAN 6GHz 802.11ax HE20/HE40/HE80/HE160 Bluetooth LE ZigBee: O-QPSK
Antenna Type	WLAN: PCB Antenna Bluetooth: PCB Antenna ZigBee: PCB Antenna
HW Version	FGR1
SW Version	6.2p30s1
EUT Stage	Identical Prototype

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. This device support beamforming for WLAN 2.4GHz 802.11n/ac/ax HT20/HT40//VHT20/VHT40/HE20/HE40, WLAN 5GHz 802.11n/ac/ax HT20/HT40/VHT20/VHT40/VHT80/VHT160/HE20/HE40/HE80/HE160, WLAN 6GHz 802.11ax HE20/HE40/HE80/HE160.
3. The device supports 1S4T(CDD&TXBF).
4. WLAN2.4GHz/WLAN5GHz all support SISO and MIMO mode, we chose MIMO tune up power to perform MPE calculation conservatively.

Comments and Explanations:
1. The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.
2. The maximum RF output tune up power, antenna gain also the safe distance used for evaluate RF exposure were declared by manufacturer.

Antenna Gain:

WLAN	Ant.0	Ant.1	Ant.2	Ant.3	Ant.4	Ant.8	Beamforming
WLAN2.4GHz	-	5.22	2.98	3.57	3.73	-	5.84
WLAN5.2GHz	-	4.10	3.93	2.18	2.48	-	5.82
WLAN5.3GHz	-	4.65	3.28	2.00	2.34	-	5.77
WLAN5.5GHz	-	5.36	4.38	3.02	2.65	-	5.98
WLAN5.8GHz	-	5.31	0.95	3.26	3.46	-	5.86
WLAN6GHz	-	4.14	5.44	5.98	6.09	-	7.58
Bluetooth	3.04	-	-	-	-	-	-
ZigBee	-	-	-	-	-	5.26	-

3. Maximum RF average output tune up power among production units

<Bluetooth>

Mode		Maximum Average power(dBm)
Bluetooth	LE	11.0

<ZigBee>

Mode		Maximum Average power(dBm)
2.4GHz	ZigBee	21.00

<For CDD/MIMO mode>

<2.4GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2+3+4
2.4GHz	802.11b	30.00
	802.11g	30.00
	802.11n-HT20	30.00
	802.11n-HT40	30.00
	802.11ac-VHT20	30.00
	802.11ac-VHT40	30.00
	802.11ax-HE20	30.00
	802.11ax-HE40	30.00

<5GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2+3+4
5.2GHz	802.11a	30.00
	802.11n-HT20	30.00
	802.11n-HT40	29.00
	802.11ac-VHT20	30.00
	802.11ac-VHT40	29.00
	802.11ac-VHT80	23.00
	802.11ax-HE20	30.00
	802.11ax-HE40	29.00
	802.11ax-HE80	23.00
5.3GHz	802.11a	23.98
	802.11n-HT20	23.98
	802.11n-HT40	23.98
	802.11ac-VHT20	23.98
	802.11ac-VHT40	23.98
	802.11ac-VHT80	23.98
	802.11ac-VHT160	23.00
	802.11ax-HE20	23.98
	802.11ax-HE40	23.98
	802.11ax-HE80	23.98
	802.11ax-HE160	23.00
5.5GHz	802.11a	23.98
	802.11n-HT20	23.98
	802.11n-HT40	23.98
	802.11ac-VHT20	23.98
	802.11ac-VHT40	23.98
	802.11ac-VHT80	23.98
	802.11ac-VHT160	22.00
	802.11ax-HE20	23.98
	802.11ax-HE40	23.98
	802.11ax-HE80	23.98
	802.11ax-HE160	22.00
5.8GHz	802.11a	27.00
	802.11n-HT20	29.00
	802.11n-HT40	29.00
	802.11ac-VHT20	29.00
	802.11ac-VHT40	29.00
	802.11ac-VHT80	27.00
	802.11ax-HE20	29.00
	802.11ax-HE40	29.00
	802.11ax-HE80	27.00

<6GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2+3+4
6GHz	802.11ax-HE20	10.00
	802.11ax-HE40	13.00
	802.11ax-HE80	16.00
	802.11ax-HE160	18.00

Note: WLAN2.4GHz/WLAN5GHz/6GHz all support SISO/MIMO mode, we only chose MIMO tune up power to perform MPE calculation conservatively for MIMO power is higher.

<For Beamforming mode>

<2.4GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2+3+4
2.4GHz	802.11n-HT20	30.00
	802.11n-HT40	30.00
	802.11ac-VHT20	30.00
	802.11ac-VHT40	30.00
	802.11ax-HE20	30.00
	802.11ax-HE40	30.00

<5GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2+3+4
5.2GHz	802.11n-HT20	29.00
	802.11n-HT40	29.00
	802.11ac-VHT20	29.00
	802.11ac-VHT40	29.00
	802.11ac-VHT80	20.00
	802.11ax-HE20	29.00
	802.11ax-HE40	29.00
	802.11ax-HE80	20.00
5.3GHz	802.11n-HT20	23.98
	802.11n-HT40	23.98
	802.11ac-VHT20	23.98
	802.11ac-VHT40	23.98
	802.11ac-VHT80	23.00
	802.11ac-VHT160	19.00
	802.11ax-HE20	23.98
	802.11ax-HE40	23.98
	802.11ax-HE80	23.00
	802.11ax-HE160	19.00
5.5GHz	802.11n-HT20	23.98
	802.11n-HT40	23.98
	802.11ac-VHT20	23.98
	802.11ac-VHT40	23.98

	802.11ac-VHT80	23.98
	802.11ac-VHT160	22.00
	802.11ax-HE20	23.98
	802.11ax-HE40	23.98
	802.11ax-HE80	23.98
	802.11ax-HE160	22.00
5.8GHz	802.11n-HT20	26.00
	802.11n-HT40	26.00
	802.11ac-VHT20	26.00
	802.11ac-VHT40	26.00
	802.11ac-VHT80	25.00
	802.11ax-HE20	26.00
	802.11ax-HE40	26.00
	802.11ax-HE80	25.00

<6GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2+3+4
6GHz	802.11ax-HE20	12.00
	802.11ax-HE40	15.00
	802.11ax-HE80	18.00
	802.11ax-HE160	20.00

Note: This device support beamforming for WLAN 2.4GHz 802.11n/ac/ax HT20/HT40//VHT20/VHT40/HE20/HE40, WLAN 5GHz 802.11n/ac/ax HT20/HT40/VHT20/VHT40/VHT80/VHT160/HE20/HE40/HE80/HE160, WLAN 6GHz 802.11ax HE20/HE40/HE80/HE160

4. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f2)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f2)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

The MPE was calculated at 26 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

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

Where:
S = Power Density
P = Output Power at Antenna Terminals
G = Gain of Transmit Antenna (linear gain)
R = Distance from Transmitting Antenna

5. Radio Frequency Radiation Exposure Evaluation

5.1. Standalone Power Density Calculation

<For CDD/MIMO mode>

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Average EIRP (mW)	Power Density at 26cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
2.4GHz WLAN	2412.0	5.22	30.00	35.220	3326.596	0.392	1.000	0.392
5.2GHz WLAN	5180.0	4.10	30.00	34.100	2570.396	0.303	1.000	0.303
5.3GHz WLAN	5260.0	4.65	23.98	28.630	729.458	0.086	1.000	0.086
5.5GHz WLAN	5500.0	5.36	23.98	29.340	859.014	0.101	1.000	0.101
5.8GHz WLAN	5745.0	5.31	29.00	34.310	2697.739	0.318	1.000	0.318
6GHz WLAN	5925.0	6.09	18.00	24.090	256.448	0.030	1.000	0.030
Bluetooth	2402.0	3.04	11.00	14.040	25.351	0.003	1.000	**0.003**
ZigBee	2405.0	5.26	21.00	26.260	422.669	0.050	1.000	**0.050**

<For Beamforming mode>

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Average EIRP (mW)	Power Density at 26cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
2.4GHz WLAN	2412.0	5.84	30.00	35.840	3837.072	0.452	1.000	**0.452**
5.2GHz WLAN	5180.0	5.82	29.00	34.820	3033.891	0.357	1.000	**0.357**
5.3GHz WLAN	5260.0	5.77	23.98	29.750	944.061	0.111	1.000	0.111
5.5GHz WLAN	5500.0	5.98	23.98	29.960	990.832	0.117	1.000	0.117
5.8GHz WLAN	5745.0	5.86	26.00	31.860	1534.617	0.181	1.000	0.181
6GHz WLAN	5925.0	7.58	20.00	27.580	572.796	0.067	1.000	**0.067**

Note:
1. For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.
2. Chose the maximum power to do MPE analysis.
3. WLAN2.4GHz, WLAN5GHz and WLAN6GHz chose the higher SISO gain as MIMO gain to perform MPE calculation.

5.2. Collocated Power Density Calculation

WLAN2.4GHz Power Density / Limit	WLAN5GHz Power Density / Limit	WLAN6GHz Power Density / Limit	Bluetooth Power Density / Limit	ZigBee Power Density / Limit	Σ(Power Density / Limit) of WLAN2.4GHz + WLAN5GH + WLAN6GHz+ Bluetooth + ZigBee
0.452	0.357	0.067	0.003	0.050	0.929

Note:

1. For colocation analysis, choose the highest (power density/limit) among WLAN 2.4GHz/5GHz/6GHz MIMO mode and Beamforming mode respectively.
2. Σ(Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WLAN2.4GHz + WLAN5GHz + WLAN6GHz+ Bluetooth + ZigBee.
3. Considering all transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 5 collocated transmitters is compliant.

Conclusion:

According to 47 CFR §2.1091, the MPE was calculated at 26 cm to show compliance with the power density limit,the RF exposure analysis concludes that the RF Exposure is FCC compliant.

------THE END------