FCC RF Exposure Report

Report No.:	MFBEDV-WTW-P23030565
FCC ID:	G95RG525FNA
Model No.:	RG525FNA
Received Date:	2023/3/16
Issued Date:	2023/7/27
Applicant:	Vantiva USA LLC
Address:	4855 Peachtree Industrial Blvd. Suite 200 Norcross, Georgia 30092
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan
FCC Registration / Designation Number:	788550 / TW0003

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Release Control Record

Issue No.	Description	Date Issued
MFBEDV-WTW-P23030565	Original release	2023/7/27

1 Certificate of Conformity

Product:	Module
Brand:	Vantiva
Test Model:	RG525FNA
Sample Status:	Engineering sample
Applicant:	Vantiva USA LLC
FCC Rule Part:	FCC Part 2 (Section 2.1091)
Standards:	KDB 447498 D01 General RF Exposure Guidance v06

We, **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, declare that the equipment above has been found compliance with the requirement limits of applicable standards. The test record, data evaluation and Equipment Under Test (EUT) configurations represented herein are true and accurate under the standards herein specified.

Prepared by : Pettie Chen , **Date:** 2023/7/27

Pettie Chen / Senior Specialist

Approved by : Jeremy Lin , **Date:** 2023/7/27

Jeremy Lin / Project Engineer

2 General Information

2.1 General Description of EUT

Product	Module	
Brand	Vantiva	
Test Model	RG525FNA	
Status of EUT	Engineering sample	
Power Supply Rating	Refer to Note	
Modulation Type	WLAN	2.4GHz Band: CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in VHT mode 1024QAM for OFDMA in 11ax mode only 5.0GHz Band: 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode 1024QAM for OFDMA in 11ax HE mode
	LTE	QPSK, 16QAM, 64QAM, 256QAM
	5G NR	$\pi/2$ BPSK, QPSK, 16QAM, 64QAM, 256QAM
Modulation Technology	WLAN	DSSS, OFDM, OFDMA
Transfer Rate	WLAN	2.4GHz Band: 802.11b: 11.0 / 5.5 / 2.0 / 1.0 Mbps 802.11g: 54.0 / 48.0 / 36.0 / 24.0 / 18.0 / 12.0 / 9.0 / 6.0 Mbps 802.11n: up to 600 Mbps VHT: up to 800 Mbps 802.11ax: up to 1147.1 Mbps 5.0GHz Band 802.11a: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 600Mbps 802.11ac: up to 3466.7Mbps 802.11ax: up to 4803.9Mbps
Operating Frequency	WLAN	2.4GHz: 2412MHz ~ 2462MHz 5.0GHz: 5180 ~ 5250MHz, 5250 ~ 5320MHz, 5500 ~ 5720MHz, 5745 ~ 5825MHz

Operating Frequency	LTE Band 2	1850MHz ~ 1910MHz
	LTE Band 4	1710MHz ~ 1755MHz
	LTE Band 5	824MHz ~ 849MHz
	LTE Band 7	2500MHz ~ 2570MHz
	LTE Band 12	699MHz ~ 716MHz
	LTE Band 13	777MHz ~ 787MHz
	LTE Band 25	1850MHz ~ 1915MHz
	LTE Band 26	814MHz ~ 849MHz
	LTE Band 38	2570MHz ~ 2620MHz
	LTE Band 41	2496MHz ~ 2690MHz
	LTE Band 48	3550MHz ~ 3700MHz
	LTE Band 66	1710MHz ~ 1780MHz
	LTE Band 71	663MHz ~ 698MHz
	5G NR n2	1850MHz ~ 1910MHz
	5G NR n5	824MHz ~ 849MHz
	5G NR n12	699MHz ~ 716MHz
	5G NR n25	1850MHz ~ 1915MHz
	5G NR n38	2570MHz ~ 2620MHz
	5G NR n41	2570MHz ~ 2620MHz
	5G NR n66	1710MHz ~ 1780MHz
	5G NR n71	663MHz ~ 698MHz
	5G NR n77	3450MHz ~ 3550MHz, 3700MHz-3980MHz
Number of Channel	WLAN 2.4GHz	2412MHz ~ 2472MHz: 8802.11b, 802.11g, 802.11n (HT20), VHT20, 802.11ax (HE20):11 802.11n (HT40), VHT40, 802.11ax (HE40):7
	WLAN 5.0GHz	5180 ~ 5250MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20): 4 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40): 2 802.11ac (VHT80), 802.11ax (HE80): 1 5250 ~ 5320MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20): 4 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40): 2 802.11ac (VHT80), 802.11ax (HE80): 1 802.11ac (VHT160), 802.11ax (HE160): 1 5500 ~ 5720MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20): 12 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40): 6 802.11ac (VHT80), 802.11ax (HE80): 3 802.11ac (VHT160), 802.11ax (HE160): 1 5745 ~ 5825MHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20): 5 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40): 2 802.11ac (VHT80), 802.11ax (HE80): 1
Antenna Type	WLAN	Refer to note

	WCDMA	Refer to note
	LTE	Refer to note
	5G NR	Refer to note

Note:

1. The EUT is authorized for use in specific End-product. Please refer to below for more details.

Item	Brand	Model	FCC ID
WIFI Gateway	Vantiva	MGA5331	G95MGA5331

2. The adapter for the End-product.

AC Adapter		
Brand	Model	Specification
HONOR	ADS-42FI-12 12042EPCU-L	AC Input: 100-120V~ 50/60Hz 1.2A max. DC Output: 12VDC, 3.5A, 42W DC Output Cable: 1.5m, Non-Shielded

3. The EUT incorporates a MIMO function:

2.4 GHz Band		
Modulation Mode	TX & RX Configuration	
802.11b	4TX	4RX
802.11g	4TX	4RX
802.11n (HT20)	4TX	4RX
802.11n (HT40)	4TX	4RX
VHT20	4TX	4RX
VHT40	4TX	4RX
802.11ax (HE20)	4TX	4RX
802.11ax (HE40)	4TX	4RX

Note:

1. All of modulation mode support beamforming function except 802.11b/g modulation mode.
2. The EUT support Beamforming and CDD mode, therefore both mode were investigated and the worst case scenario was identified. The worst case data were presented in test report.
3. The EUT device modulation technique OFDMA does not support partial RUs (resource units) and channel puncturing/bandwidth reduction mechanisms.

5 GHz Band		
Modulation Mode	TX & RX Configuration	
802.11a	4TX	4RX
802.11n (HT20)	4TX	4RX
802.11n (HT40)	4TX	4RX
802.11ac (VHT20)	4TX	4RX
802.11ac (VHT40)	4TX	4RX
802.11ac (VHT80)	4TX	4RX
802.11ax (HE20)	4TX	4RX
802.11ax (HE40)	4TX	4RX
802.11ax (HE80)	4TX	4RX

Note:

1. All of modulation mode support beamforming function except 802.11a modulation mode.
2. The EUT support Beamforming and CDD mode, therefore both mode were investigated and the worst case scenario was identified. The worst case data were presented in test report.
3. The modulation and bandwidth are similar for 802.11n mode for 20 MHz (40 MHz), 802.11ac mode for 20 MHz (40 MHz, 80 MHz) and 802.11ax mode for 20 MHz (40 MHz, 80 MHz), therefore the manufacturer will control the power for 802.11n/ac mode is the same as the 802.11ax or more lower than it and investigated worst case to representative mode in test report.
4. The EUT device modulation technique OFDMA does not support partial RUs (resource units) and channel puncturing/bandwidth reduction mechanisms.

4. The WLAN antenna information is listed as below.

Antenna Type	PCB			
Connector Type	ipex(MHF)			
Band	Max Gain (dBi)			
	Chain 0	Chain 1	Chain 2	Chain 3
2.4GHz	1.28	-0.72	-4.58	-2.14
5G Band 1	1.51	-0.18	0.73	-0.12
5G Band 2	1.03	1.28	2.03	0.09
5G Band 3	2.62	-0.26	2.19	2.19
5G Band 4	0.47	-0.29	2.81	0.47

Band	Directional Gain (dBi)
2.4GHz	3.21
5G Band 1	5.6
5G Band 2	5.48
5G Band 3	6.01
5G Band 4	6.48

5. The WWAN antenna information is listed as below.

Antenna Type	PCB			
Antenna Connector	Ipex(MHF)			
Item	Band	TX Ant	Gain (dBi)	
			ANT0	ANT3
LTE	Band 2	Ant 0	5.05	3.47
	Band 4	Ant 0	4.84	3.96
	Band 5	Ant 0	2.38	1.58
	Band 7	Ant 3	5.02	5.70
	Band 12	Ant 0	1.12	1.99
	Band 13	Ant 0	1.59	0.87
	Band 25	Ant 0	5.05	3.47
	Band 26 (Part 22)	Ant 0	2.38	1.75
	Band 26 (Part 90)	Ant 0	2.30	1.58
	Band 38	Ant 3	5.43	6.11
	Band 41	Ant 3	5.43	6.17
	Band 48	Ant 3	4.47	4.85
	Band 66	Ant 0	4.84	3.96
	Band 71	Ant 0	1.12	1.99
5G NR FR1	n2	Ant 0	5.05	3.47
	n5	Ant 0	2.38	1.58
	n12	Ant 0	1.12	1.99
	n25	Ant 0	5.05	3.47
	n38	Ant 3	5.43	6.11
	n41	Ant 3 UL-MIMO: Ant 0+3	5.43	6.17
	n66	Ant 0	4.84	3.96
	n71	Ant 0	1.12	1.99
	n77/n78 (3450MHz-3550MHz)	Ant 0 UL-MIMO: Ant 0+3	3.65	3.72
	n77/n78 (3700MHz-3980MHz)	Ant 0 UL-MIMO: Ant 0+3	5.37	4.59

* Detail antenna specification please refer to antenna datasheet an antenna gain measurement report.

6. The max tune-up power is listed as below.

Mode	Max Power (dBm)	
	CDD mode	Beamforming mode
WLAN 2.4GHz	29.80	29.23
WLAN 5.18 ~ 5.25GHz	29.75	29.75
WLAN 5.25 ~ 5.32GHz	23.97	23.97
WLAN 5.50 ~ 5.720GHz	23.81	23.81
WLAN 5.745 ~ 5.825GHz	29.93	29.44

Mode	Conducted Power (dBm)	EIRP (dBm)
LTE Band 2	21.52	26.57
LTE Band 4	21.47	26.31
LTE Band 7	21.68	27.38
LTE Band 25	21.63	26.68
LTE Band 38	24.31	30.42
LTE Band 41	24.33	30.50
LTE Band 48	-	20.63
LTE Band 66	21.55	26.39

Function	Frequency Band (MHz)	Conducted Power (dBm)	ERP (dBm)
LTE Band 5	824.7-848.3	22.66	22.89
LTE Band 26 (Part 22)	824.7-848.3	22.40	22.63
LTE Band 12	699.7-715.3	22.61	21.58
LTE Band 13	779.5-784.5	22.38	22.25
LTE Band 26 (Part 90)	814.7-823.3	22.32	22.47
LTE Band 71	665.5-695.5	22.44	21.41

Mode	Conducted Power (dBm)	EIRP (dBm)
SA		
5G NR n2	22.29	27.34
5G NR n25	22.39	27.44
5G NR n38	25.52	31.63
5G NR n41	25.92	32.09
5G NR n66	22.11	26.95
5G NR n77 (Part 27Q)	25.87	29.52
5G NR n77 (Part 27O)	24.61	29.98
UL-MIMO		
5G NR n41	-	25.57
5G NR n77 (Part 27Q)	-	24.41
5G NR n77 (Part 27O)	-	25.61

Function	Conducted Power (dBm)	ERP (dBm)
5G NR n5	22.82	23.05
5G NR n12	22.99	21.96
5G NR n71	23.02	21.99

3 RF Exposure

3.1 Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (minutes)
Limits For General Population / Uncontrolled Exposure				
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/1500	30
1500-100,000	…	…	1.0	30

f = Frequency in MHz; *Plane-wave equivalent power density

3.2 MPE Calculation Formula

$Pd = (Pout*G) / (4*pi*r^2)$
where
Pd = power density in mW/cm^2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
pi = 3.1416
r = distance between observation point and center of the radiator in cm

3.3 Classification

The antenna of this product, under normal use condition, is at least 25cm away from the body of the user. So, this device is classified as **Mobile Device**.

4 Calculation Result of Maximum Conducted Power

Mode	Max Power (dBm)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
CDD mode					
WLAN 2.4GHz	29.80	1.28	25	0.163	1.00
WLAN 5.18 ~ 5.25GHz	29.75	1.51	25	0.170	1.00
WLAN 5.25 ~ 5.32GHz	23.97	2.03	25	0.051	1.00
WLAN 5.50 ~ 5.720GHz	23.81	2.62	25	0.056	1.00
WLAN 5.745 ~ 5.825GHz	29.93	2.81	25	0.239	1.00
Beamforming mode					
WLAN 2.4GHz	29.23	3.21	25	0.223	1.00
WLAN 5.18 ~ 5.25GHz	29.75	5.6	25	0.436	1.00
WLAN 5.25 ~ 5.32GHz	23.97	5.48	25	0.112	1.00
WLAN 5.50 ~ 5.720GHz	23.81	6.01	25	0.122	1.00
WLAN 5.745 ~ 5.825GHz	29.44	6.48	25	0.498	1.00

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.4GHz: Directional gain = 3.21dBi
5.18 ~ 5.25GHz: Directional gain = 5.6dBi
5.25 ~ 5.32GHz: Directional gain = 5.48dBi
5.50 ~ 5.720GHz: Directional gain = 6.01dBi
5.745 ~ 5.825GHz: Directional gain = 6.48dBi

Mode	EIRP (dBm)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
LTE Band 2	26.57	25	0.058	1.000
LTE Band 4	26.31	25	0.054	1.000
LTE Band 7	27.38	25	0.070	1.000
LTE Band 25	26.68	25	0.059	1.000
LTE Band 38	30.42	25	0.140	1.000
LTE Band 41	30.50	25	0.143	1.000
LTE Band 48	20.63	25	0.015	1.000
LTE Band 66	26.39	25	0.055	1.000

Function	Frequency Band (MHz)	ERP (dBm)	EIRP (dBm)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
LTE Band 5	824.7-848.3	22.89	25.04	25	0.041	0.550
LTE Band 26 (Part 22)	824.7-848.3	22.63	24.78	25	0.038	0.550
LTE Band 12	699.7-715.3	21.58	23.73	25	0.030	0.466
LTE Band 13	779.5-784.5	22.25	24.40	25	0.035	0.520
LTE Band 26 (Part 90)	814.7-823.3	22.47	24.62	25	0.037	0.543
LTE Band 71	665.5-695.5	21.41	23.56	25	0.029	0.444

Mode	EIRP (dBm)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
SA				
5G NR n2	27.34	25	0.069	1.000
5G NR n25	27.44	25	0.071	1.000
5G NR n38	31.63	25	0.185	1.000
5G NR n41	32.09	25	0.206	1.000
5G NR n66	26.95	25	0.063	1.000
5G NR n77 (Part 27Q)	29.52	25	0.114	1.000
5G NR n77 (Part 27O)	29.98	25	0.127	1.000
UL-MIMO				
5G NR n41	25.57	25	0.046	1.000
5G NR n77 (Part 27Q)	24.41	25	0.035	1.000
5G NR n77 (Part 27O)	25.61	25	0.046	1.000

Function	ERP (dBm)	EIRP (dBm)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
5G NR n5	23.05	25.20	25	0.042	0.549
5G NR n12	21.96	24.11	25	0.033	0.466
5G NR n71	21.99	24.14	25	0.033	0.442

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

Conclusion:

WLAN 2.4G & WLAN 5GHz & WWAN can transmit simultaneously, the formula of calculated the MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ……etc. < 1

CPD = Calculation power density

LPD = Limit of power density

WLAN 2.4GHz + WLAN 5GHz + WWAN = 0.223 / 1 + 0.498 / 1 + 0.206 / 1 = 0.927

Therefore the maximum calculations of above situations are less than the “1” limit.

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