RF EXPOSURE EVALUATION REPORT

FCC ID	**: TVE-3901M12**
Equipment	**: Network Security Gateway**
Brand Name	**: FORTINET**
Model Name	**: FortiWiFi 50G-5Gxxxxxxxxxx, FORTIWIFI-50G-5Gxxxxxxxxxx, FWF-50G-5Gxxxxxxxxxx, FortiWiFi 51G-5Gxxxxxxxxxx, FORTIWIFI-51G-5Gxxxxxxxxxx, FWF-51G-5Gxxxxxxxxxx**
	(where "x" can be used as "A-Z", or "0-9", or "-", or blank for software purposes or marketing purposes only)
Marketing Name	**: FortiWiFi 50G-5G, FortiWiFi 51G-5G**
Applicant	**: Fortinet Inc. 899 KIFER RD SUNNYVALE CA 94086 UNITED STATES**
Manufacturer	**: Fortinet Inc. 899 KIFER RD SUNNYVALE CA 94086 UNITED STATES**
Standard	**: 47 CFR Part 2.1091**

We, SPORTON INTERNATIONAL INC has been evaluated this product in accordance with 47 CFR Part2.1091 and it complies with applicable limit.

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 1190) and the FCC designation No. TW1190 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC evaluation.

The results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. Laboratory, the test report shall not be reproduced except in full.

Approved by: Cona Huang / Deputy Manager

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History of this test report

Report No.	Version	Description	Issued Date
FA3D0631	Rev. 01	Initial issue of report	Feb. 10, 2024

1. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	Network Security Gateway
Brand Name	FORTINET
Model Name	FortiWiFi 50G-5Gxxxxxxxxxx, FORTIWIFI-50G-5Gxxxxxxxxxx, FWF-50G-5Gxxxxxxxxxx, FortiWiFi 51G-5Gxxxxxxxxxx, FORTIWIFI-51G-5Gxxxxxxxxxx, FWF-51G-5Gxxxxxxxxxx (where “x” can be used as “A-Z”, or “0-9”, or “-“, or blank for software purposes or marketing purposes only)
Marketing Name	FortiWiFi 50G-5G, FortiWiFi 51G-5G
FCC ID	TVE-3901M12
Wireless Technology and Frequency Range	WLAN 2.4 GHz Band: 2400 MHz ~ 2483.5 MHz WLAN 5.2 GHz Band: 5150 MHz ~ 5250 MHz WLAN 5.8 GHz Band: 5725 MHz ~ 5850 MHz
Mode	WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 WLAN 11ax HE20/HE40/HE80
EUT Stage	Production Unit

Integrated Bluetooth Module	
Brand Name	FORTINET
Model Name	FBLE-2024TI
Wireless Technology and Frequency Range	Bluetooth: 2400 MHz ~ 2483.5 MHz
Mode	Bluetooth LE
Remark: 1. The Bluetooth operation is also integrated into this host, additional power density result Sim-Tx analysis is meet FCC requirement. The Bluetooth RF Exposure were referred from Sporton report, report number FA3D0610, FCC ID: TVE-110T17	

Integrated WWAN Module	
Wireless Technology and Frequency Range	WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 14: 788 MHz ~ 798 MHz LTE Band 17: 704 MHz ~ 716 MHz LTE Band 25: 1850 MHz ~ 1915 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 30: 2305 MHz ~ 2315 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 42: 3450 MHz ~ 3550 MHz, 3550 MHz ~ 3600 MHz LTE Band 43: 3600 MHz ~ 3700 MHz LTE Band 48: 3550 MHz ~ 3700 MHz LTE Band 66: 1710 MHz ~ 1780 MHz LTE Band 71: 663 MHz ~ 698 MHz 5G NR n2 : 1850 MHz ~ 1910 MHz 5G NR n5 : 824 MHz ~ 849 MHz 5G NR n7 : 2500 MHz ~ 2570 MHz 5G NR n25 : 1850 MHz ~ 1915 MHz 5G NR n30 : 2305 MHz ~ 2315 MHz 5G NR n38 : 2570 MHz ~ 2620 MHz 5G NR n41 : 2496 MHz ~ 2690 MHz 5G NR n48 : 3550 MHz ~ 3700 MHz 5G NR n66 : 1710 MHz ~ 1780 MHz 5G NR n71 : 663 MHz ~ 698 MHz 5G NR n77: 3450 MHz ~ 3550 MHz, 3700 MHz ~ 3980 MHz 5G NR n78: 3450 MHz ~ 3550 MHz, 3700 MHz ~ 3800 MHz
Mode	RMC 12.2Kbps HSDPA HSUPA DC-HSDPA LTE: QPSK, 16QAM, 64QAM, 256QAM 5G NR: DFT-s-OFDM/CP-OFDM, Pi/2 BPSK/QPSK/16QAM/64QAM/256QAM
Remark: 1. The WWAN operation is also integrated into this host, additional power density result Sim-Tx analysis is meet FCC requirement.	

Reviewed by: Jason Wang

Report Producer: Wan Liu

2. Maximum RF average output power among production units

<WLAN2.4GHz non-Beamforming mode>

	Mode	Channel	Frequency (MHz)	Port 3+6 (3) Tune-up Limit	Port 3+6 (6) Tune-up Limit	Port 3+6 Tune-up Limit
2.4GHz WLAN	802.11b 1Mbps	1	2412	22.00	22.00	25.00
		6	2437	23.50	23.50	26.50
		10	2457	20.50	20.50	23.50
		11	2462	20.00	20.00	23.00
	802.11g 6Mbps	1	2412	19.50	19.50	22.50
		6	2437	21.50	21.50	24.50
		10	2457	18.50	18.50	21.50
		11	2462	17.50	17.50	20.50
	802.11n-HT20 MCS0	1	2412	18.50	18.50	21.50
		6	2437	21.00	21.00	24.00
		10	2457	18.50	18.50	21.50
		11	2462	17.00	17.00	20.00
	802.11n-HT40 MCS0	3	2422	17.00	17.00	20.00
		6	2437	18.00	18.00	21.00
		9	2452	17.00	17.00	20.00
	802.11ax-HE20 MCS0	1	2412	18.50	18.50	21.50
		2	2417	19.00	19.00	22.00
		6	2437	21.50	21.50	24.50
		10	2457	18.50	18.50	21.50
		11	2462	18.00	18.00	21.00
	802.11ax-HE40 MCS0	3	2422	17.00	17.00	20.00
		6	2437	18.00	18.00	21.00
		9	2452	17.00	17.00	20.00

<WLAN5GHz non-Beamforming mode>

	Mode	Channel	Frequency (MHz)	Port 3+6 (3) Tune-up Limit	Port 3+6 (6) Tune-up Limit	Port 3+6 Tune-up Limit
5.2GHz WLAN	802.11a 6Mbps	36	5180	21.50	21.50	24.50
		44	5220	24.00	24.00	27.00
		48	5240	25.50	25.50	28.50
	802.11n-HT20 MCS0	36	5180	21.50	21.50	24.50
		44	5220	24.00	24.00	27.00
		48	5240	24.00	24.00	27.00
	802.11n-HT40 MCS0	38	5190	19.00	19.00	22.00
		46	5230	21.00	21.00	24.00
	802.11ac-VHT20 MCS0	36	5180	22.00	22.00	25.00
		44	5220	23.50	23.50	26.50
		48	5240	24.50	24.50	27.50
	802.11ac-VHT40 MCS0	38	5190	19.50	19.50	22.50
		46	5230	21.00	21.00	24.00
	802.11ac-VHT80 MCS0	42	5210	15.50	15.50	18.50
	802.11ax-HE20 MCS0	36	5180	22.00	22.00	25.00
		44	5220	23.50	23.50	26.50
		48	5240	25.50	25.50	28.50
	802.11ax-HE40 MCS0	38	5190	19.00	19.00	22.00
		46	5230	21.00	21.00	24.00
	802.11ax-HE80 MCS0	42	5210	15.00	15.00	18.00

	Mode	Channel	Frequency (MHz)	Port 3+6 (3) Tune-up Limit	Port 3+6 (6) Tune-up Limit	Port 3+6 Tune-up Limit
5.8GHz WLAN	802.11a 6Mbps	149	5745	26.80	26.80	29.80
		157	5785	26.70	26.70	29.70
		165	5825	26.50	26.50	29.50
	802.11n-HT20 MCS0	149	5745	26.90	26.90	29.90
		157	5785	26.70	26.70	29.70
		165	5825	25.50	25.50	28.50
	802.11n-HT40 MCS0	151	5755	25.50	25.50	28.50
		159	5795	24.50	24.50	27.50
	802.11ac-VHT20 MCS0	149	5745	26.90	26.90	29.90
		157	5785	26.70	26.70	29.70
		165	5825	25.50	25.50	28.50
	802.11ac-VHT40 MCS0	151	5755	25.50	25.50	28.50
		159	5795	24.50	24.50	27.50
	802.11ac-VHT80 MCS0	155	5775	22.00	22.00	25.00
	802.11ax-HE20 MCS0	149	5745	26.90	26.90	29.90
		157	5785	26.70	26.70	29.70
		165	5825	25.50	25.50	28.50
	802.11ax-HE40 MCS0	151	5755	25.50	25.50	28.50
		159	5795	24.50	24.50	27.50
	802.11ax-HE80 MCS0	155	5775	20.50	20.50	23.50

<WLAN2.4GHz Beamforming mode>

	Mode	Channel	Frequency (MHz)	Port 3+6 (3) Tune-up Limit	Port 3+6 (6) Tune-up Limit	Port 3+6 Tune-up Limit
2.4GHz WLAN	802.11n-HT20 MCS0	1	2412	18.50	18.50	21.50
		6	2437	21.00	21.00	24.00
		10	2457	18.50	18.50	21.50
		11	2462	17.00	17.00	20.00
	802.11n-HT40 MCS0	3	2422	17.00	17.00	20.00
		6	2437	18.00	18.00	21.00
		9	2452	17.00	17.00	20.00
	802.11ax-HE20 MCS0	1	2412	18.50	18.50	21.50
		2	2417	19.00	19.00	22.00
		6	2437	21.50	21.50	24.50
		10	2457	18.50	18.50	21.50
		11	2462	18.00	18.00	21.00
	802.11ax-HE40 MCS0	3	2422	17.00	17.00	20.00
		6	2437	18.00	18.00	21.00
		9	2452	17.00	17.00	20.00

<WLAN5GHz Beamforming mode>

	Mode	Channel	Frequency (MHz)	Port 3+6 (3) Tune-up Limit	Port 3+6 (6) Tune-up Limit	Port 3+6 Tune-up Limit
5.2GHz WLAN	802.11n-HT20 MCS0	36	5180	21.50	21.50	24.50
		44	5220	24.00	24.00	27.00
		48	5240	24.00	24.00	27.00
	802.11n-HT40 MCS0	38	5190	19.00	19.00	22.00
		46	5230	21.00	21.00	24.00
	802.11ac-VHT20 MCS0	36	5180	22.00	22.00	25.00
		44	5220	23.50	23.50	26.50
		48	5240	24.50	24.50	27.50
	802.11ac-VHT40 MCS0	38	5190	19.50	19.50	22.50
		46	5230	21.00	21.00	24.00
	802.11ac-VHT80 MCS0	42	5210	15.50	15.50	18.50
	802.11ax-HE20 MCS0	36	5180	22.00	22.00	25.00
		44	5220	23.50	23.50	26.50
		48	5240	25.50	25.50	28.50
	802.11ax-HE40 MCS0	38	5190	19.00	19.00	22.00
		46	5230	21.00	21.00	24.00
	802.11ax-HE80 MCS0	42	5210	15.00	15.00	18.00

	Mode	Channel	Frequency (MHz)	Port 3+6 (3) Tune-up Limit	Port 3+6 (6) Tune-up Limit	Port 3+6 Tune-up Limit
5.8GHz WLAN	802.11n-HT20 MCS0	149	5745	26.90	26.90	29.90
		157	5785	26.70	26.70	29.70
		165	5825	25.50	25.50	28.50
	802.11n-HT40 MCS0	151	5755	25.50	25.50	28.50
		159	5795	24.50	24.50	27.50
	802.11ac-VHT20 MCS0	149	5745	26.90	26.90	29.90
		157	5785	26.70	26.70	29.70
		165	5825	25.50	25.50	28.50
	802.11ac-VHT40 MCS0	151	5755	25.50	25.50	28.50
		159	5795	24.50	24.50	27.50
	802.11ac-VHT80 MCS0	155	5775	22.00	22.00	25.00
	802.11ax-HE20 MCS0	149	5745	26.90	26.90	29.90
		157	5785	26.70	26.70	29.70
		165	5825	25.50	25.50	28.50
	802.11ax-HE40 MCS0	151	5755	25.50	25.50	28.50
		159	5795	24.50	24.50	27.50
	802.11ax-HE80 MCS0	155	5775	20.50	20.50	23.50

Integrated WWAN operation

Mode		Maximum Average power(dBm)
WCDMA	Band II	24.5
	Band IV	24.5
	Band V	24.5
LTE	Band 2	24
	Band 4	24
	Band 5	24
	Band 7	24
	Band 12	24
	Band 13	24
	Band 14	24
	Band 17	24
	Band 25	24
	Band 26	24
	Band 30	23
	Band 38	24
	Band 41	26.5
	Band 42	22.5
	Band 43	22.5
	Band 48	22.5
	Band 66	24
	Band 71	24
NR	Band 2	24.5
	Band 5	24.5
	Band 7	24.5
	Band 25	24.5
	Band 30	23
	Band 38	25
	Band 41	27.5
	Band 48	22.5
	Band 66	24.5
	Band 71	24.5
	Band 77	27.5
	Band 78	27.5

3. 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

4. Radio Frequency Radiation Exposure Evaluation

4.1. Standalone Power Density Calculation

<WWAN>

Band	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 26cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
WCDMA Band 2	1.52	24.5	26.0	0.40	399.94	0.047	1.000	0.047
WCDMA Band 4	2.96	24.5	27.5	0.56	557.19	0.066	1.000	0.066
WCDMA Band 5	1.82	24.5	26.3	0.43	428.55	0.050	0.549	0.092
LTE Band 2	1.52	24.0	25.5	0.36	356.45	0.042	1.000	0.042
LTE Band 4	2.96	24.0	27.0	0.50	496.59	0.058	1.000	0.058
LTE Band 5	1.82	24.0	25.8	0.38	381.94	0.045	0.549	0.082
LTE Band 7	0.85	24.0	24.9	0.31	305.49	0.036	1.000	0.036
LTE Band 12	-0.70	24.0	23.3	0.21	213.80	0.025	0.466	0.054
LTE Band 13	-0.33	24.0	23.7	0.23	232.81	0.027	0.518	0.053
LTE Band 14	0.30	24.0	24.3	0.27	269.15	0.032	0.525	0.060
LTE Band 17	-0.76	24.0	23.2	0.21	210.86	0.025	0.469	0.053
LTE Band 25	1.68	24.0	25.7	0.37	369.83	0.044	1.000	0.044
LTE Band 26	1.82	24.0	25.8	0.38	381.94	0.045	0.543	0.083
LTE Band 30	0.41	23.0	23.4	0.22	219.28	0.026	1.000	0.026
LTE Band 38	0.94	24.0	24.9	0.31	311.89	0.037	1.000	0.037
LTE Band 41	2.62	26.5	29.1	0.82	816.58	0.096	1.000	0.096
LTE Band 42	0.26	22.5	22.8	0.19	188.80	0.022	1.000	0.022
LTE Band 43	0.03	22.5	22.5	0.18	179.06	0.021	1.000	0.021
LTE Band 48	0.03	22.5	22.5	0.18	179.06	0.021	1.000	0.021
LTE Band 66	2.96	24.0	27.0	0.50	496.59	0.058	1.000	0.058
LTE Band 71	-0.55	24.0	23.5	0.22	221.31	0.026	0.442	0.059
5G NR Band 2	1.52	24.5	26.0	0.40	399.94	0.047	1.000	0.047
5G NR Band 5	1.82	24.5	26.3	0.43	428.55	0.050	0.549	0.092
5G NR Band 7	0.85	24.5	25.4	0.34	342.77	0.040	1.000	0.040
5G NR Band 25	1.68	24.5	26.2	0.41	414.95	0.049	1.000	0.049
5G NR Band 30	0.41	23.0	23.4	0.22	219.28	0.026	1.000	0.026
5G NR Band 38	0.94	25.0	25.9	0.39	392.64	0.046	1.000	0.046
5G NR Band 41	2.62	27.5	30.1	1.03	1028.02	0.121	1.000	0.121
5G NR Band 48	0.03	22.5	22.5	0.18	179.06	0.021	1.000	0.021
5G NR Band 66	2.96	24.5	27.5	0.56	557.19	0.066	1.000	0.066
5G NR Band 71	-0.55	24.5	24.0	0.25	248.31	0.029	0.442	0.066
5G NR Band 77	0.26	27.5	27.8	0.60	597.04	0.070	1.000	0.070
5G NR Band 78	0.26	27.5	27.8	0.60	597.04	0.070	1.000	0.070

<non-Beamforming mode>

Band	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 26cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
WLAN2.4GHz Band	0.31	26.50	26.81	0.48	479.73	0.057	1.000	0.057
WLAN5.2GHz Band	2.54	28.50	31.04	1.27	1270.57	0.150	1.000	0.150
WLAN5.8GHz Band	2.50	29.90	32.40	1.74	1737.80	0.205	1.000	0.205

<Beamforming mode>

Band	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 26cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
WLAN2.4GHz Band	3.32	24.50	27.82	0.61	605.34	0.071	1.000	0.071
WLAN5.2GHz Band	5.55	28.50	34.05	2.54	2540.97	0.299	1.000	0.299
WLAN5.8GHz Band	5.51	29.90	35.41	3.48	3475.36	0.409	1.000	0.409

Note:

1. This device supports Beamforming for WLAN 2.4GHz VHT20/VHT40/HE20/HE40 and WLAN 5GHz HT20/HT40/VHT20/VHT40/VHT80/HE20/HE40/HE80 only; therefore, in the table above which consider maximum directional Gain 3.32dBi for WLAN 2.4GHz Beamforming mode and 5.55dBi and 5.51dBi for WLAN 5GHz Beamforming mode.

4.2. Collocated Power Density Calculation

<non-Beamforming mode>

EN-DC		2.4GHz WLAN Power Density / Limit	5GHz WLAN Power Density / Limit	Bluetooth Power Density / Limit	Σ(Power Density / Limit)
LTE Power Density / Limit	5G NR Power Density / Limit				
0.096	0.121	0.057	0.205	0.002	0.481

<Beamforming mode>

EN-DC		2.4GHz WLAN Power Density / Limit	5GHz WLAN Power Density / Limit	Bluetooth Power Density / Limit	Σ(Power Density / Limit)
LTE Power Density / Limit	5G NR Power Density / Limit				
0.096	0.121	0.071	0.409	0.002	0.699

Note:

1. ∑(Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for LTE + 5G NR + WLAN + Bluetooth.
2. Considering all 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 RF exposure analysis concludes that the RF Exposure is FCC compliant.