RADIO EXPOSURE TEST REPORT

FCC ID	:	TVE-111M01A
Equipment	:	Secured Network Extension Device
Brand Name	:	FORTINET
Model Name	:	FortiExtender 312Fxxxxxx, FORTIEXTENDER-312Fxxxxxx, FEX-312Fxxxxxx, FortiExtender 311Fxxxxxx, FORTIEXTENDER-311Fxxxxxx, FEX-311Fxxxxxx (Refer to section 1.5 for detail information)
Applicant	:	Fortinet, Inc. 899 Kifer Road, Sunnyvale, CA 94086 USA
Manufacturer	:	Fortinet, Inc. 899 Kifer Road, Sunnyvale, CA 94086 USA
Standard	:	47 CFR Part 2.1091

The product was received on Jun. 28, 2021, and testing was started from Jul. 08, 2021 and completed on Aug. 03, 2021. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR Part 2.1091 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

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Photographs of EUT v01

History of this test report

Report No.	Version	Description	Issued Date
FA162527	01	Initial issue of report	Dec. 28, 2021

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
2	-	Exposure evaluation	PASS	-
Note: Reference to Sporton Project No.: 162527-02				

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
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 presented declaration output power of WWAN for EUT in the report are provided by the manufacturer, and We, Sporton International Inc. Hsinchu Laboratory does not guarantee its accuracy.

Reviewed by: Sam Chen

Report Producer: Viola Huang

1 General Description

1.1 EUT General Information

RF General Information				
Evaluation Mode		**Frequency Range (MHz)**	**Operating Frequency (MHz)**	**Modulation Type**
Bluetooth		2400-2483.5	2402-2480	BR / EDR: FHSS (GFSK / π/4-DQPSK / 8DPSK) LE: GFSK
Evaluation Mode		**Uplink Frequency Range (MHz)**	**Downlink Frequency Range (MHz)**	**Modulation Type**
WCDMA	Band 2	1850~1910	1930~1990	BPSK / QPSK / 16QAM / 64QAM
	Band 4	1710~1755	2110~2155	
	Band 5	824~849	869~894	
LTE	Band 2	1850~1910	1930~1990	QPSK / 16QAM / 64QAM / 256QAM
	Band 4	1710~1755	2110~2155	
	Band 5	824~849	869~894	
	Band 7	2500~2570	2620~2690	
	Band 12	699~716	729~746	
	Band 13	777~787	746~756	
	Band 14	788~798	758~768	
	Band 25	1850~1915	1930~1995	
	Band 26	814~849	859~894	
	Band 30	2305~2315	2350~2360	
	Band 38	2570~2620		
	Band 40	2300~2400		
	Band 41	2496~2690		
	Band 48	3550~3700		
	Band 66	1710~1780		

1.2 Antenna Information

For Bluetooth antenna

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1	WIESON	102700000021A	Chip Antenna	N/A	1.08

Note: The above information was declared by manufacturer.

For bluetooth mode (1TX/1RX)

Only port 1 can be used as transmitting/receiving antenna.

1.3 Table of Mode

Test Mode	
1	EUT 1_LTE Band Sim 1 (Upper left) + LTE Band Sim 1 (Lower left) + Bluetooth
2	EUT 1_LTE Band Sim 1 (Upper left) + WCDMA Band Sim 1 (Lower left) + Bluetooth
3	EUT 1_WCDMA Band Sim 1 (Upper left) + LTE Band Sim 1 (Lower left) + Bluetooth
4	EUT 1_WCDMA Band Sim 1 (Upper left) + WCDMA Band Sim 1 (Lower left) + Bluetooth
5	EUT 2_LTE Band Sim 1 + Bluetooth
6	EUT 2_WCDMA Band Sim 1 + Bluetooth

1.4 Table for Multiple Listing

Equipment Name	EUT No.	Model Name	Description
Secured Network Extension Device	EUT 1	FortiExtender 312Fxxxxxx, FORTIEXTENDER-312Fxxxxxx, FEX-312Fxxxxxx (where “x” can be “0-9”, or “A-Z”, or “-“, or blank for marketing purposes or software changes only and no Safety or EMC related changes)	Contain two certified WWAN Modules
Secured Network Extension Device	EUT 2	FortiExtender 311Fxxxxxx, FORTIEXTENDER-311Fxxxxxx, FEX-311Fxxxxxx (where “x” can be “0-9”, or “A-Z”, or “-“, or blank for marketing purposes or software changes only and no Safety or EMC related changes)	Contain one certified WWAN Module

Note 1: From the above models, model: FEX-312F (EUT 1), FEX-311F (EUT 2) were selected as representative model for the test and its data was recorded in this report.

Note 2: The above information was declared by manufacturer.

1.5 Accessories

N/A

2 Maximum Permissible Exposure

2.1 Limit of Maximum Permissible Exposure

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time |E|²,|H|² or S (minutes)
0.3-3.0	614	1.63	*(100)	<6
3.0-30	1842/f	4.89/f	*(900/f^2)	<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

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	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/1500	<30
1500-100,000	-	-	1.0	<30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

2.2 MPE Calculation Method

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

E (V/m) = $\frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (W/m²) = $\frac{E^2}{377}$

E = Electric field (V/m)

P = RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

Pd = $\frac{30 \times P \times G}{377 \times d^2}$

2.3 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)
2.4G;BT-BR	1.08	12.23	13.31	0.50	13.81	0.02404	20	0.00478	1.00000
2.4G;BT-LE	1.08	11.99	13.07	0.50	13.57	0.02275	20	0.00453	1.00000

Simultaneous Transmission Analysis:

Mode 1: EUT 1_LTE Band 26 + LTE Band 26 + Bluetooth

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Ratio (S/Limit)
LTE Band 26	1.68	25.00	26.68	0.50	27.18	0.52240	20	0.10392	0.54267	0.19150
LTE Band 26	1.68	25.00	26.68	0.50	27.18	0.52240	20	0.10392	0.54267	0.19150
2.4G;BT-BR	1.08	12.23	13.31	0.50	13.81	0.02404	20	0.00478	1.00000	0.00478
									Sum Ratio	0.38778
									Ratio Limit	1

Mode 2: EUT 1_LTE Band 26 + WCDMA Band 5 + Bluetooth

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Ratio (S/Limit)
LTE Band 26	1.68	25.00	26.68	0.50	27.18	0.52240	20	0.10392	0.54267	0.19150
WCDMA Band 5	1.66	25.00	26.66	0.50	27.16	0.52000	20	0.10345	0.54933	0.18832
2.4G;BT-BR	1.08	12.23	13.31	0.50	13.81	0.02404	20	0.00478	1.00000	0.00478
									Sum Ratio	0.38460
									Ratio Limit	1

Mode 3: EUT 1_WCDMA Band 5 + LTE Band 26 + Bluetooth

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Ratio (S/Limit)
WCDMA Band 5	1.66	25.00	26.66	0.50	27.16	0.52000	20	0.10345	0.54933	0.18832
LTE Band 26	1.68	25.00	26.68	0.50	27.18	0.52240	20	0.10392	0.54267	0.19150
2.4G;BT-BR	1.08	12.23	13.31	0.50	13.81	0.02404	20	0.00478	1.00000	0.00478
									Sum Ratio	0.38460
									Ratio Limit	1

Mode 4: EUT 1_WCDMA Band 5 + WCDMA Band 5 + Bluetooth

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Ratio (S/Limit)
WCDMA Band 5	1.66	25.00	26.66	0.50	27.16	0.52000	20	0.10345	0.54933	0.18832
WCDMA Band 5	1.66	25.00	26.66	0.50	27.16	0.52000	20	0.10345	0.54933	0.18832
2.4G;BT-BR	1.08	12.23	13.31	0.50	13.81	0.02404	20	0.00478	1.00000	0.00478
									Sum Ratio	0.38142
									Ratio Limit	1

Mode 5: EUT 2_LTE Band Sim 1 + Bluetooth

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Ratio (S/Limit)
LTE Band 26	1.68	25.00	26.68	0.50	27.18	0.52240	20	0.10392	0.54267	0.19150
2.4G;BT-BR	1.08	12.23	13.31	0.50	13.81	0.02404	20	0.00478	1.00000	0.00478
									Sum Ratio	0.19628
									Ratio Limit	1.00000

Mode 6: EUT 2_WCDMA Band Sim 1 + Bluetooth

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)	Ratio (S/Limit)
WCDMA Band 5	1.66	25.00	26.66	0.50	27.16	0.52000	20	0.10345	0.54933	0.18832
2.4G;BT-BR	1.08	12.23	13.31	0.50	13.81	0.02404	20	0.00478	1.00000	0.00478
									Sum Ratio	0.19310
									Ratio Limit	1.00000

Note: The above antenna gain was declared by manufacturer.

———THE END———