RF Exposure Evaluation Report

Application No.:	SZCR2104020387AT
Applicant:	Fortinet Inc.
Address of Applicant:	899 Kifer Road, Sunnyvale, California, 94086 United States
Manufacturer:	Fortinet, Inc.
Address of Manufacturer:	899 Kifer Road, Sunnyvale, California, 94086 United States
Equipment Under Test (EUT):	
EUT Name:	Secured Network Extension Device
Model No.:	FEX-511F, FortiExtender 511Fxxxxxx, FORTIEXTENDER-511Fxxxxxx, FEX-511Fxxxxxx (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) ♣
♣	Please refer to section 4.1 of this report which indicates which model was actually tested and which were electrically identical.
Trade Mark:	FORTINET
FCC ID:	TVE-251M01
Standards:	47 CFR Part 1.1307
	47 CFR Part 1.1310
	47 CFR Part 2.1091
Date of Receipt:	2021-04-07
Date of Test:	2021-04-11 to 2021-07-09
Date of Issue:	2021-07-14
Test Result :	**PASS***

* In the configuration tested, the EUT complied with the standards specified above.

Keny Xu
EMC Laboratory Manager

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

2 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2021-07-14		Original

Authorized for issue by:				
		Damon Su **Calvin Weng /Project Engineer**		
		Eric Fu **Eric Fu /Reviewer**		

3 Contents

4 General Information

4.1 General Description of EUT

Power supply:	DC 12V by adapter. Adapter Model: WA-30P12R Input: AC 100-240V 50/60Hz Output: DC 12V 2.5A
For BT	
Operation Frequency:	2402MHz to 2480MHz
Modulation Type:	GFSK, pi/4DQPSK, 8DPSK
Number of Channels:	79
Channel Spacing:	1MHz
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
Antenna Type:	PIFA Antenna
Antenna Gain:	3.5dBi
For BLE	
Bluetooth Version:	V5.0
Operation Frequency:	2402MHz to 2480MHz
Modulation Type:	GFSK
Channel Spacing:	2MHz
Date Rate:	1Mbps, 2Mbps
Number of Channels:	40
Antenna Type:	PIFA Antenna
Antenna Gain:	3.5dBi

For WCDMA/LTE	
Operation Frequency Band:	WCDMA Band II/ WCDMA Band V/ WCDMA Band IV LTE FDD Band 2, 4, 5, 7, 12, 13, 14, 17, 25, 26, 30, 38, 41, 48, 66, 71 5G NR: n2, n5, n7, n12, n25, n41, n66, n71, n77
Modulation Type:	QPSK for WCDMA; QPSK, 16QAM for LTE;
HSDPA UE Category:	13
HSUPA UE Category:	6
LTE Release Version:	R8
LTE Power Class:	Level 3
Scs for NR Cell:	FDD Band: 15KHz; TDD Band: 30KHz
Modulation for NR:	UL & DL up to 256QAM
Antenna Type:	Dipole Antenna
Antenna Gain:	WCDMA Band II/IV, LTE Band 2/4/7/25/30/38/41/66 and 5G NR n2/7/25/41/66: 3.8 dBi WCDMA Band V, LTE Band 5/12/13/14/17/26/71 and 5G NR n5/12/71: 1.64 dBi LTE Band 48: -0.94dBi; 5G NR n77: 3.35 dBi
Based on Module certification(FCC ID: XMR2020RM502QAE)	

Remark: The EUT equipped with 5G module Quectel RM502Q-AE which support WCDMA/LTE/5G NR(Based on Module certification, FCC ID: XMR2020RM502QAE)

Declaration of EUT Family Grouping:

Model No.: FEX-511F, FortiExtender 511Fxxxxxx, FORTIEXTENDER-511Fxxxxxx, FEX-511Fxxxxxx (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)

Only the model FEX-511F was tested. According to the declaration from the applicant, the electrical circuit design, layout, components used, internal wiring and functions were identical for the above models, with only difference on marketing purposes or software with on EMC related changes.

4.2 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch
No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.
Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

4.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• **VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.
Designation Number: CN1178. Test Firm Registration Number: 406779.

• **Innovation, Science and Economic Development Canada**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.
CAB identifier: CN0006.
IC#: 4620C.

4.4 Deviation from Standards

None.

4.5 Abnormalities from Standard Conditions

None.

4.6 Other Information Requested by the Customer

None.

5 RF Exposure Evaluation

5.1 RF Exposure Compliance Requirement

5.1.1 Limits

According to FCC Part1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in part1.1307(b)

TABLE 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)	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	*($900/f^2$)	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				
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

Friis Formula

Friis transmission formula: Pd = (Pout*G)/(4* Pi * R 2)

Where

Pd = power density in mW/cm2

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

Pd id the limit of MPE, 1 mW/cm2 . If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

5.1.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

4.1.3 EUT RF Exposure Evaluation

For BT:

Antenna Gain: 3.5dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.24 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit	Result
2402	5.46	3.52	0.0016	1.0	PASS

Note: Refer to report No. SZCR210402038702 for EUT test Max Conducted Peak Output Power value. The distance r (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

For BLE:

Antenna Gain: 3.5dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.24 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Frequency (MHz)	Max Conducted Peak Output Power (dBm)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm^2)	Limit	Result
2402	10.44	11.07	0.0049	1.0	PASS

Note: Refer to report No. SZCR210402038704 for EUT test Max Conducted Peak Output Power value. The distance r (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

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For WCDMA/LTE/5G NR

Based on Module certification(FCC ID: XMR2020RM502QAE), refer to report No. 2010RSU005-U8 for WCDMA/LTE/5G NR Module test Max Conducted Peak Output Power value.
The distance r (4th column) calculated from the Fries transmission formula is far greater than 20 cm separation requirement.

Test Mode	Maximum Conducted Power (dBm)	Antenna Gain (dBi)	Power (mW)	Power Density at 20cm (mW/cm2)	Limit (mW/cm2)	MPE Ratio
WCDMA B2	25.00	3.8	758.58	0.1509	0.4476	0.3372
WCDMA B4	25.00	3.8	758.58	0.1509	0.4242	0.3558
WCDMA B5	25.00	1.64	461.32	0.0918	0.2576	0.3563
LTE B2	25.00	3.8	758.58	0.1509	0.4476	0.3372
LTE B4	25.00	3.8	758.58	0.1509	0.4242	0.3558
LTE B5	25.00	1.64	461.32	0.0918	0.2576	0.3563
LTE B7	25.00	3.8	758.58	0.1509	0.5499	0.2744
LTE B12	25.00	1.64	461.32	0.0918	0.2302	0.3987
LTE B13	25.00	1.64	461.32	0.0918	0.2474	0.3710
LTE B14	25.00	1.64	461.32	0.0918	0.2498	0.3674
LTE B17	25.00	1.64	461.32	0.0918	0.2313	0.3968
LTE B25	25.00	3.8	758.58	0.1509	0.4476	0.3372
LTE B26	25.00	1.64	461.32	0.0918	0.2554	0.3593
LTE B30	25.00	3.8	758.58	0.1509	0.5202	0.2901
LTE B38	28.00	3.8	1513.56	0.3011	0.5604	0.5373
LTE B41	28.00	3.8	1513.56	0.3011	0.5493	0.5482
LTE B48	23.70	-0.94	188.80	0.0304	0.6988	0.0435
LTE B66	25.00	3.8	758.58	0.1509	0.4242	0.3558
LTE B71	25.00	1.64	461.32	0.0918	0.2220	0.4134
n2	25.00	3.8	758.58	0.1509	0.4476	0.3372
n5	25.00	1.64	461.32	0.0918	0.2576	0.3563
n7	25.00	3.8	758.58	0.1509	0.5499	0.2744
n12	25.00	1.64	461.32	0.0918	0.2302	0.3987

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n25	25.00	3.8	758.58	0.1509	0.4476	0.3372
n41	28.00	3.8	1513.56	0.3011	0.5493	0.5482
n66	25.00	3.8	758.58	0.1509	0.4242	0.3558
n71	25.00	1.64	461.32	0.0918	0.2220	0.4134
n77	27.00	3.35	1083.93	0.2156	0.7189	0.3000

The simultaneous transmission result between of BTand WCDMA/LTE/5G NR:
The SAR Exclusion Threshold Level:
=CPD1 / LPD1 + CPD2 / LPD2
(CPD = Calculation power density, LPD = Limit of power density)
= 0.0049 +0.5482= 0.5531 < 1
Since the SAR Exclusion Threshold Level is well below the SAR low threshold level, so the EUT is considered to comply with SAR requirement without testing.

- End of the Report -