RF Exposure Report

Report No.:	SABDUM-WTW-P21060284
FCC ID:	UXX-S5A135A
Test Model:	S5A135A
Received Date:	June 24, 2021
Test Date:	July 29, 2021
Issued Date:	Sep. 01, 2021
Applicant:	Cradlepoint, Inc
Address:	1111 W. Jefferson Street Suite 400 Boise, ID 83702 USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
Test Location:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
FCC Registration / Designation Number:	723255 / TW2022

This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification.

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
SABDUM-WTW-P21060284	Original release.	Sep. 01, 2021

1 Certificate of Conformity

Product:	SOHO Branch Router
Brand:	cradlepoint
Test Model:	S5A135A
Sample Status:	Engineering sample
Applicant:	Cradlepoint, Inc
Test Date:	July 29, 2021
Standards:	FCC Part 2 (Section 2.1091) KDB 447498 D01 General RF Exposure Guidance v06

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Vivian Huang , **Date:** Sep. 01, 2021

Vivian Hunag / Specialist

Approved by : , **Date:** Sep. 01, 2021

Clark Lin / Technical Manager

2 RF Exposure

2.1 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

2.2 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

2.3 Classification

The antenna of this product, under normal use condition, is at least 20cm away from the body of the user. So, this device is classified as **Mobile Device**.

2.4 Antenna Gain

For WLAN								
Ant. No.	RF Chain No.	Brand	Model	Ant. Net Gain (dBi)	Frequency Range (GHz)	Ant. Type	Connector Type	Cable Length (mm)
1	WiFi Chain0	Cradlepoint	ANT1_N03UEADA-T10-PK1-B130U	5	2.4~2.4835	PCB	i-pex(MHF)	130
				4.9	5.15~5.25			
				4.3	5.25~5.35			
				4.3	5.47~5.725			
				4.3	5.725~5.85			
2	WiFi Chain1	Cradlepoint	ANT2_N03UEADA-T-PK1-G230U	3.4	2.4~2.4835	PCB	i-pex(MHF)	230
				4.5	5.15~5.25			
				1.9	5.25~5.35			
				1.9	5.47~5.725			
				1.9	5.725~5.85			
For WWAN								
Ant. Set	RF Chain No.	Brand	Model	Antenna Net Gain (dBi)	Frequency Range (MHz)	Antenna Type	Connector Type	Cable Length (mm)
3	LTE MAIN	Cradlepoint	YWX-UM03SAX9-711B	1.1	615~960	Dipole	SMA	95
				0.6	1445~1515			
				2.63	1710~2700			
				4	3400~3800			
4	LTE AUX	Cradlepoint	YWX-UM03SAX9-711B	1.1	615~960	Dipole	SMA	95
				0.6	1445~1515			
				2.63	1710~2700			
				4	3400~3800			
Note: Max. gain was selected for the final test.								

Note: The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

2.5 Calculation Result of Maximum Conducted Power

Operation Mode	Evaluation Frequency (MHz)	Max. Average Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
WiFi 2.4GHz	2412~2462	271.049	7.25	20	0.28627	1
WiFi 5G (U-NII-1)	5180-5240	105.674	7.71	20	0.12408	1
WiFi 5G (U-NII-2A)	5260-5320	123.345	6.19	20	0.10206	1
WiFi 5G (U-NII-2C)	5500-5720	190.402	6.19	20	0.15754	1
WiFi 5G (U-NII-3)	5745-5825	106.396	6.19	20	0.08804	1

Note:

1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. 2.4GHz: Directional gain = 10 log[$(10^{G0/20} + 10^{G1/20})^2$ / 2] = 7.25 dBi
3. 5GHz:
   U-NII-1: Directional gain =10 log[$(10^{G0/20} + 10^{G1/20}$ / 2] = 7.71 dBi
   U-NII-2A & U-NII-2C & U-NII-3: Directional gain = 10 log[$(10^{G0/20} + 10^{G1/20}$ / 2] = 6.19 dBi

For WWAN module - Worst Case (FCC ID: N7NMC74B):

Operation Mode	Evaluation Frequency (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
LTE 71	663-698	193	1.10	20	0.04946	0.442

Conclusion:

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 + WWAN = 0.28627 / 1 + 0.04946 / 0.442= 0.39817
WLAN 5GHz + WWAN = 0.15754 / 1 + 0.04946 / 0.442 = 0.26944
WLAN 2.4GHz + WLAN 5GHz = 0.28627 / 1 + 0.15754 / 1 = 0.44381
WLAN 2.4GHz + WLAN 5GHz + WWAN = 0.28627 / 1 + 0.15754 / 1 + 0.04946 / 0.442 = 0.55571

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

Appendix

WWAN module (FCC ID: N7NMC74B)
MPE Evaluation

Mode	Equipment Category	Transmitter Range (MHz)		Maximum Power		Antenna Gain (dBi)	Power Density (mW/cm^2)		Ratio
		Start	Stop	(mW)	(dBm)		Vaule	Limit	
WCDMA	WCDMA II	1850	1910	174	22.41	2.63	0.06343	1	0.06343
	WCDMA IV	1710	1755	169	22.28	2.63	0.06161	1	0.06161
	WCDMA V	824	849	185	22.67	1.10	0.04741	0.54933	0.08631
LTE	LTE B2	1850	1910	158	21.99	2.63	0.05760	1	0.05760
	LTE B4	1710	1755	166	22.20	2.63	0.06051	1	0.06051
	LTE B5	824	849	181	22.58	1.10	0.04639	0.54933	0.08445
	LTE B7	2500	2570	138	21.40	2.63	0.05030	1	0.05030
	LTE B12	699	716	203	23.07	1.10	0.05203	0.46533	0.11181
	LTE B13	777	787	200	23.01	1.10	0.05126	0.518	0.09896
	LTE B14	788	798	199	22.99	1.10	0.05100	0.52533	0.09708
	LTE B25	1850	1915	158	21.99	2.63	0.05760	1	0.05760
	LTE (Band 26) (Part 90S)	814	824	176	22.46	1.10	0.04511	0.54267	0.08313
	LTE (Band 26) (Part 22H)	824	849	181	22.58	1.10	0.04639	0.54933	0.08445
	LTE (Band 41)	2496	2690	144	21.58	2.63	0.05249	1	0.05249
	LTE (Band 42)	3550	3600	71	18.51	4.00	0.03548	1	0.03548
	LTE (Band 43)	3600	3700	71	18.51	4.00	0.03548	1	0.03548
	LTE (Band 48)	3550	3700	71	18.51	4.00	0.03548	1	0.03548
	LTE (Band 66)	1710	1780	166	22.20	2.63	0.06051	1	0.06051
	LTE (Band 71)	663	698	193	22.86	1.10	0.04946	0.442	0.11190
	LTE CA Band 5B	824	849	211	23.24	1.10	0.05408	0.54933	0.09845
	LTE CA Band 7C	2500	2570	192	22.83	2.63	0.06999	1	0.06999
	LTE CA Band 41C	2496	2690	187	22.72	2.63	0.06817	1	0.06817

Distance = 20 cm

--- END ---