RF Exposure Report

Report No.:	SA160914E09G
FCC ID:	UXX-S5A643A
Test Model:	S5A643A
Series Model:	S5A644A
Received Date:	Mar. 15, 2019
Test Date:	Apr. 23, 2019
Issued Date:	May 02, 2019
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 R.O.C.
Test Location:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
FCC Registration / Designation Number:	723255 / TW2022

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
SA160914E09G	Original release.	May 02, 2019

1 Certificate of Conformity

Product: 2x2 Dual Band Concurrent AP

Brand: Cradlepoint

Test Model: S5A643A

Series Model: S5A644A

Sample Status: ENGINEERING SAMPLE

Applicant: Cradlepoint, Inc

Test Date: Apr. 23, 2019

Standards: FCC Part 2 (Section 2.1091)
KDB 447498 D01 General RF Exposure Guidance v06
IEEE C95.1-1992

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 : Wendy Wu , **Date:** May 02, 2019
Wendy Wu / Specialist

Approved by : , **Date:** May 02, 2019
May Chen / 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 40cm away from the body of the user. So, this device is classified as **Mobile Device**.

2.4 Antenna Gain

Newly					
Ant Set	Element	Antenna Gain(dBi) Including cable loss	Frequency Range (GHz)	Antenna Type	Connector Type
2	WLAN (Chain 1 & 2)	1.5	2400-2.500	PIFA	R-SMA
		2	5150-5250		
		2	5250-5350		
		1.9	5470-5725		
		1.9	5725-5900		
	LTE (Chain 1 & 2)	3.8	698-960	PIFA	SMA
		4.4	1710-3800		
	GNSS (Chain 1)	RX only: 26dB (with LNA)	1562-1612	Patch	SMA
3	WLAN (Chain 1, 2, 3, 4)	1.5	2400-2.500	Monopole	R-SMA
		1	5150-5250		
		1	5250-5350		
		0.9	5470-5725		
		0.9	5725-5900		
	LTE (Chain 1, 2, 3, 4)	3.8	698-960	PIFA	SMA
		5.4	1710-3800		
	GNSS (Chain 1)	RX only: 26dB (with LNA)	1562-1612	Patch	SMA

2.5 Calculation Result of Maximum Conducted Power

For Antenna Set 2:

For WLAN:

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2412-2462	590.041	4.51	40	0.08290	1
5180-5240	170.344	5.01	40	0.02685	1
5260-5320	208.225	5.01	40	0.03282	1
5500-5700	200.296	4.91	40	0.03086	1
5745-5825	331.536	4.91	40	0.05107	1

NOTE:
2.4GHz: Directional gain = 1.5dBi + 10log(2) = 4.51dBi
5GHz (U-NII-1 & UNII-2A band): Directional gain = 2dBi + 10log(2) = 5.01dBi
5GHz (U-NII-2C & U-NII-3 band): Directional gain = 1.9dBi + 10log(2) = 4.91dBi

For WWAN(LTE) module (FCC ID: N7NMC7455)

Frequency (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
699	251	3.80	40	0.02995	0.466*

Note: *Limit of Power Density = F/1500

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 + WLAN 5GHz + WWAN= 0.08290 /1 + 0.05107 / 1 + 0.02995 / 0.466 = 0.19824

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

For Antenna Set 3:

For WLAN:

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2412-2462	590.041	4.51	40	0.08290	1
5180-5240	170.344	4.01	40	0.02133	1
5260-5320	208.225	4.01	40	0.02607	1
5500-5700	200.296	3.91	40	0.02451	1
5745-5825	331.536	3.91	40	0.04057	1

NOTE:
2.4GHz: Directional gain = 1.5dBi + 10log(2) = 4.51dBi
5GHz (U-NII-1 & UNII-2A band): Directional gain = 1dBi + 10log(2) = 4.01dBi
5GHz (U-NII-2C & U-NII-3 band): Directional gain = 0.9dBi + 10log(2) = 3.91dBi

For WWAN(LTE) module (FCC ID: N7NMC7455)

Frequency (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm^2)	Limit (mW/cm^2)
699	251	3.80	40	0.02995	0.466*

Note: *Limit of Power Density = F/1500

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 + WLAN 5GHz + WWAN= 0.08290 /1 + 0.04057 / 1 + 0.02995 / 0.466 = 0.18774

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

--- END ---

Appendix

For Antenna Set 2:

MPE Evaluation for WWAN(LTE) module (FCC ID: N7NMC7455)

Operating Mode	TX Freq Range (MHz)		Max Output Power		Antenna Gain (dBi)	Power Density (mW/cm^2)		Ratio
	Start	Stop	(dBm)	(W)		Vaule	Limit	
WCDMA Band II LTE Band 2	1850	1910	24	0.25	4.4	0.0343	1	0.03425
WCDMA Band IV LTE Band 4	1710	1755	24	0.25	4.4	0.0343	1	0.03425
WCDMA Band V LTE Band 5	824	849	24	0.25	3.8	0.0298	0.54933	0.054303
LTE Band 7	2500	2570	23	0.2	4.4	0.0274	1	0.0274
LTE Band 12	699	716	24	0.25	3.8	0.0298	0.466	**0.064013**
LTE Band 13	777	787	24	0.25	3.8	0.0298	0.518	0.057587
LTE Band 25	1850	1915	24	0.25	4.4	0.0343	1	0.03425
LTE Band 26	814	849	24	0.25	3.8	0.0298	0.54266	0.05497
LTE Band 41	2496	2690	23	0.2	4.4	0.0274	1	0.0274

For Antenna Set 3:

MPE Evaluation for WWAN(LTE) module (FCC ID: N7NMC7455)

Operating Mode	TX Freq Range (MHz)		Max Output Power		Antenna Gain (dBi)	Power Density (mW/cm^2)		Ratio
	Start	Stop	(dBm)	(W)		Vaule	Limit	
WCDMA Band II LTE Band 2	1850	1910	24	0.25	5.4	0.0431	1	0.04311
WCDMA Band IV LTE Band 4	1710	1755	24	0.25	5.4	0.0431	1	0.04311
WCDMA Band V LTE Band 5	824	849	24	0.25	3.8	0.0298	0.54933	0.054303
LTE Band 7	2500	2570	23	0.2	5.4	0.0345	1	0.03449
LTE Band 12	699	716	24	0.25	3.8	0.0298	0.466	**0.064013**
LTE Band 13	777	787	24	0.25	3.8	0.0298	0.518	0.057587
LTE Band 25	1850	1915	24	0.25	5.4	0.0431	1	0.04311
LTE Band 26	814	849	24	0.25	3.8	0.0298	0.54266	0.05497
LTE Band 41	2496	2690	23	0.2	5.4	0.0345	1	0.03449