

RF Exposure Report

Report No.: SA170825E04G

FCC ID: UXX-S5A741A

Test Model: S5A844A

Series Model: S5A741A

Received Date: Nov. 14, 2018

Test Date: Dec. 11, 2018

Issued Date: Dec. 27, 2018

Applicant: Cradlepoint, Inc

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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**FCC Registration /
Designation Number:** 723255 / TW2022

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Release Control Record

Issue No.	Description	Date Issued
SA170825E04G	Original release.	Dec. 27, 2018

1 Certificate of Conformity

Product: Integrated Mobile Broadband Router

Brand: cradlepoint

Test Model: S5A844A

Series Model: S5A741A

Sample Status: ENGINEERING SAMPLE

Applicant: Cradlepoint, Inc

Test Date: Dec. 11, 2018

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 :



Date:

Dec. 27, 2018

Wendy Wu / Specialist

Approved by :



Date:

Dec. 27, 2018

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/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

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

Model: S5A741A											
WLAN											
Ant Set.	Transmitter Circuit			Model	Frequency range (GHz)	Ant Type	Connector Type	Cable Length (mm)	Cable Loss(dB)	excluding cable loss Ant Gain(dBi)	Ant Net Gain (dBi)
	Radio 1		Radio 2								
	2.4G	5G	5G								
1	GPIO 0 Chain0	Chain1	-	RFA-25-F17M3-B70-25	2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5	1.7 2.1
	GPIO 0 Chain1	Chain0	-		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5	1.7 2.1
	GPIO 1 Chain1	-	Chain2		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5	1.7 2.1
	-	-	Chain3		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5	1.7 2.1
	-	-	Chain0		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5	1.7 2.1
	GPIO 1 Chain0	-	Chain1		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5	1.7 2.1
	2	GPIO 0 Chain0	Chain1		-	TWX-1513RSXX-711	2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4
GPIO 0 Chain1		Chain0	-	2.4~2.4835 5.15~5.85	Dipole		R-SMA	230	0.8 1.4	5 5	4.2 3.6
GPIO 1 Chain1		-	Chain2	2.4~2.4835 5.15~5.85	Dipole		R-SMA	230	0.8 1.4	5 5	4.2 3.6
-		-	Chain3	2.4~2.4835 5.15~5.85	Dipole		R-SMA	230	0.8 1.4	5 5	4.2 3.6
-		-	Chain0	2.4~2.4835 5.15~5.85	Dipole		R-SMA	230	0.8 1.4	5 5	4.2 3.6
GPIO 1 Chain0		-	Chain1	2.4~2.4835 5.15~5.85	Dipole		R-SMA	230	0.8 1.4	5 5	4.2 3.6
3G/LTE											
Ant Set.	Transmitter Circuit	Model	Antenna Gain with cable		Frequency range	Antenna Type	Connector Type	Cable Length (mm)	Cable Loss (dB)		
			including cable loss								
1	Main	YWX-6252SABX-711	1.0dBi@2300~2320MHz 2dBi@690~2300MHz 3dBi@2320~2700MHz		2300~2320MHz 690~2300MHz 2320~2700MHz	Dipole	SMA	230		0~1G 0.5dB 1~3G 0.9dB	
	Aux	YWX-6252SABX-711	1.0dBi@2300~2320MHz 2dBi@690~2300MHz 3dBi@2320~2700MHz		2300~2320MHz 690~2300MHz 2320~2700MHz	Dipole	SMA	230		0~1G 0.5dB 1~3G 0.9dB	
2	Main	YWX-6241SAXX-711D	1.0dBi@2300~2320MHz 2dBi@690~2300MHz 3dBi@2320~2700MHz		2300~2320MHz 690~2300MHz 2320~2700MHz	Dipole	SMA	230		0~1G 0.5dB 1~3G 0.9dB	
	Aux	YWX-6241SAXX-711D	1.0dBi@2300~2320MHz 2dBi@690~2300MHz 3dBi@2320~2700MHz		2300~2320MHz 690~2300MHz 2320~2700MHz	Dipole	SMA	230		0~1G 0.5dB 1~3G 0.9dB	
GPS											
Antenna Gain with cable			Frequency range			Antenna Type	Connector Type				
including cable loss											
GPS: 1.36dBi GLONASS: 0.09dBi			GPS: 1574.42MHz±3MHz GLONASS: 1602MHz±0.5MHz			Dipole	SMA				

Model: S5A844A
WLAN

Ant Set.	Transmitter Circuit			Model	Frequency range (GHz)	Ant Type	Connector Type	Cable Length (mm)	Cable Loss(dB)	excluding cable loss Ant Gain(dBi)	Ant Net Gain (dBi)
	Radio 1		Radio 2								
	2.4G	5G	5G								
1	GPIO 0 Chain0	Chain1	-	RFA-25-F17M3-B70-25	2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5	1.7 2.1
	GPIO 0 Chain1	Chain0	-		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5	1.7 2.1
	GPIO 1 Chain1	-	Chain2		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5	1.7 2.1
	-	-	Chain3		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5	1.7 2.1
	-	-	Chain0		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5	1.7 2.1
	GPIO 1 Chain0	-	Chain1		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5	1.7 2.1
2	GPIO 0 Chain0	Chain1	-	TWX-1513RSXX-711	2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5	4.2 3.6
	GPIO 0 Chain1	Chain0	-		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5	4.2 3.6
	GPIO 1 Chain1	-	Chain2		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5	4.2 3.6
	-	-	Chain3		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5	4.2 3.6
	-	-	Chain0		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5	4.2 3.6
	GPIO 1 Chain0	-	Chain1		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5	4.2 3.6

3G/LTE

Ant Set.	Transmitter Circuit	Model	Antenna Gain with cable		Frequency range	Antenna Type	Connector Type	Cable Length (mm)	Cable Loss (dB)
			including cable loss						
1	Main	YWX-UM03SAXX-711	1.42dBi@615~960MHz 0.88dBi@1445~1515MHz 2.69dBi@1700~2700MHz 4.13dBi@3400~3700MHz 4.29dBi@5150~5925MHz	615~960MHz 1445~1515MHz 1700~2700MHz 3400~3700MHz 5150~5925MHz	Dipole	SMA	230	0~1G 0.5dB 1~3G 1.1dB	
	Aux-1	YWX-UM03SAXX-711	1.42dBi@615~960MHz 0.88dBi@1445~1515MHz 2.69dBi@1700~2700MHz 4.13dBi@3400~3700MHz 4.29dBi@5150~5925MHz	615~960MHz 1445~1515MHz 1700~2700MHz 3400~3700MHz 5150~5925MHz	Dipole	SMA	230	0~1G 0.5dB 1~3G 1.1dB	
	Aux-2	YWX-UM03SAXX-711	1.42dBi@615~960MHz 0.88dBi@1445~1515MHz 2.69dBi@1700~2700MHz 4.13dBi@3400~3700MHz 4.29dBi@5150~5925MHz	615~960MHz 1445~1515MHz 1700~2700MHz 3400~3700MHz 5150~5925MHz	Dipole	SMA	230	0~1G 0.5dB 1~3G 1.1dB	
	Aux-3	YWX-UM03SAXX-711	1.42dBi@615~960MHz 0.88dBi@1445~1515MHz 2.69dBi@1700~2700MHz 4.13dBi@3400~3700MHz 4.29dBi@5150~5925MHz	615~960MHz 1445~1515MHz 1700~2700MHz 3400~3700MHz 5150~5925MHz	Dipole	SMA	230	0~1G 0.5dB 1~3G 1.1dB	

NOTE : LTE Band 30 for DL only.

GPS

Antenna Gain with cable including cable loss	Frequency range	Antenna Type	Connecter Type
GPS: 1.36dBi GLONASS: 0.09dBi	GPS: 1574.42MHz±3MHz GLONASS: 1602MHz±0.5MHz	Dipole	SMA

Note:

1. For WLAN: Ant set 2 was selected for the final test.

2.5 Calculation Result of Maximum Conducted Power

For 2.4GHz, 5GHz (U-NII-1 band and U-NII-3 band) and 3G/LTE Modem data was copied from the original test report (Report No.: SA170825E04)

For WLAN 5GHz: Radio 1 and Radio 2 can simultaneously transmit only in different bands.

For WLAN (Radio 1)

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)
2412-2462	833.916	7.21	40	0.21817	1
5180-5240	681.538	6.61	40	0.15530	1
5260-5320	242.817	6.61	40	0.05533	1
5500-5700	237.982	6.61	40	0.05423	1
5745-5825	873.145	6.61	40	0.19896	1

NOTE:

2.4GHz: Directional gain = 4.20dBi + 10log(2) = 7.21dBi

5GHz: Directional gain = 3.60dBi + 10log(2) = 6.61dBi

For WLAN (Radio 2)

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)
5180-5240	789.037	9.62	40	0.35956	1
5260-5320	206.889	9.62	40	0.09428	1
5500-5700	242.715	9.62	40	0.11060	1
5745-5825	996.851	9.62	40	0.45425	1

NOTE:

5GHz: Directional gain = 3.60dBi + 10log(4) = 9.62dBi

For 3G/LTE (Radio 3) (FCC ID: RI7LM960)

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)
2496-2690	472	2.69	40	0.04361	1

For 3G/LTE Modem (FCC ID: N7NMC7455)

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)
698-716	251.189	1.99	40	0.01975	0.4665*

Note: *Limit of Power Density = F/1500

Conclusion:

The formula of calculated the MPE is:

$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$

CPD = Calculation power density

LPD = Limit of power density

WLAN 2.4GHz <Radio 1> + WLAN 5GHz <Radio 1> + WLAN 5GHz <Radio 2> + 3G/LTE <Radio 3> + 3G/LTE Modem = $0.21817 / 1 + 0.15530 / 1 + 0.45425 / 1 + 0.04361 / 1 + 0.01975 / 0.4665 = 0.91367$

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

Appendix

3G/LTE module

MPE Evaluation for FCC ID: RI7LM960 Radio Module

Mode	Equipment Category	Transmitter Range (MHz)		Maximum		Antenna Gain (dBi)	Power Density (mW/cm ²)		Ratio
		Start	Stop	(dBm)	(W)		Vaule	Limit	
UMTS	Band II	1852.4	1907.6	22.53	0.179	2.69	0.01654	1	0.01654
	Band IV	1712.4	1752.6	22.81	0.191	2.69	0.01765	1	0.01765
	Band V	826.4	846.6	23.54	0.226	1.42	0.01559	0.55093	0.02830
LTE	Band 2	1850.7	1909.3	23.42	0.22	2.69	0.02033	1	0.02033
	Band 4	1710.7	1754.3	24.1	0.257	2.69	0.02375	1	0.02375
	Band 5	824.7	848.3	24.05	0.254	1.42	0.01752	0.5498	0.03187
	Band 7	2502.5	2567.5	24.05	0.254	2.69	0.02347	1	0.02347
	Band 12	699.7	715.3	23.44	0.221	1.42	0.01524	0.46646	0.03267
	Band 13	779.5	784.5	23.22	0.21	1.42	0.01448	0.51966	0.02786
	Band 14	790.5	795.5	23.24	0.211	1.42	0.01455	0.527	0.02761
	Band 17	706.5	713.5	23.44	0.221	1.42	0.01524	0.471	0.03236
	Band 19	832.5	842.5	23.84	0.242	1.42	0.01669	0.555	0.03007
	Band 25	1850.7	1914.3	23.69	0.234	2.69	0.02162	1	0.02162
	Band 26	814.7	848.3	23.14	0.206	1.42	0.01421	0.54313	0.02616
	Band 38	2572.5	2617.5	24.08	0.256	2.69	0.02365	1	0.02365
	Band 41	2498.5	2687.5	26.74	0.472	2.69	0.04361	1	0.04361
Band 66	1710.7	1779.3	24	0.251	2.69	0.02319	1	0.02319	
Band 71	665.5	695.5	23.84	0.242	1.42	0.01669	0.44366	0.03762	

3G/LTE Modem
 MPE Evaluation for FCC ID: N7NMC7455 Radio Module

Operating Mode	TX Freq Range (MHz)		Max Time-Avg Cond Power		Antenna Gain (dBi)	Power Density (mW/cm ²)		Ratio
	Start	Stop	(dBm)	(W)		Valeur	Limit	
WCDMA Band II LTE Band 2	1850	1910	24	0.25	4	0.0312	1	0.03123
WCDMA Band IV LTE Band 4	1710	1755	24	0.25	4	0.0312	1	0.03123
WCDMA Band V LTE Band 5	824	849	24	0.25	1.99	0.0197	0.54933	0.03579
LTE Band 7	2500	2570	23	0.2	2.8	0.019	1	0.01895
LTE Band 12	699	716	24	0.25	1.99	0.0197	0.466	0.04219
LTE Band 13	777	787	24	0.25	1.99	0.0197	0.518	0.03795
LTE Band 25	1850	1915	24	0.25	4	0.0312	1	0.03123
LTE Band 26	814	849	24	0.25	1.99	0.0197	0.54266	0.03623
LTE Band 30	2305	2315	23	0.2	1	0.0125	1	0.01252
LTE Band 41	2496	2690	23	0.2	2.8	0.019	1	0.01895

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