

RF Exposure Report

Report No.: SA170825E04

FCC ID: UXX-S5A741A

Test Model: S5A741A

Received Date: Aug. 25, 2017

Test Date: Sep. 22 to 25, 2017

Issued Date: Oct. 16, 2017

Applicant: Cradlepoint, Inc

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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Release Control Record

Issue No.	Description	Date Issued
SA170825E04	Original release.	Oct. 16, 2017

1 Certificate of Conformity

Product: Integrated Mobile Broadband Router

Brand: cradlepoint

Test Model: S5A741A

Sample Status: ENGINEERING SAMPLE

Applicant: Cradlepoint, Inc

Test Date: Sep. 22 to 25, 2017

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:** Oct. 16, 2017
Wendy Wu / Specialist

Approved by : May Chen , **Date:** Oct. 16, 2017
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

WLAN										
Ant Set.	Transmitter Circuit			Model	Frequency range (GHz)	Antenna Type	Connector Type	Cable Length (mm)	Cable Loss(dB)	excluding cable loss Antenna 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
	GPIO 0 Chain1	Chain0	-		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5
	GPIO 1 Chain1	-	Chain2		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5
	-	-	Chain3		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5
	-	-	Chain0		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5
	GPIO 1 Chain0	-	Chain1		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5
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
	GPIO 0 Chain1	Chain0	-		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5
	GPIO 1 Chain1	-	Chain2		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5
	-	-	Chain3		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5
	-	-	Chain0		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5
	GPIO 1 Chain0	-	Chain1		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5

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

Note:

- For WLAN: Ant set 2 was selected for the final test.
- For 2.4GHz configuration mode, GPIO 0 and GPIO 1 were pre-tested and the worst case was found in GPIO 0, therefore only the test data of the modes were recorded in this report.

2.5 Calculation Result of Maximum Conducted Power

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
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
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: RI7LM940)

Frequency Band (MHz)	Max Power (mW)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)
698-716	223.9	2.00	40	0.01765	0.4665*

Note: *Limit of Power Density = F/1500

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

Note: The Max Power = Max tune up power including tolerance.

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 = $0.21817 / 1 + 0.15530 / 1 + 0.45425 / 1 + 0.01765 / 0.4665 + 0.01975 / 0.4665 = 0.90790$

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

Appendix

3G/LTE module

MPE Evaluation for FCC ID: RI7LM940 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	24	0.2512	3	0.02493	1	0.02493
	Band IV	1712.4	1752.6	24	0.2512	3	0.02493	1	0.02493
	Band V	826.4	846.6	24	0.2512	2	0.0198	0.55093	0.03594
LTE	Band 2	1850.7	1909.3	23.5	0.2239	3	0.02222	1	0.02222
	Band 4	1710.7	1754.3	23.5	0.2239	3	0.02222	1	0.02222
	Band 5	824.7	848.3	24	0.2512	2	0.0198	0.5498	0.03601
	Band 7	2502.5	2567.5	23.5	0.2239	3	0.02222	1	0.02222
	Band 12	699.7	715.3	23.5	0.2239	2	0.01765	0.46646	0.03784
	Band 13	779.5	784.5	23.5	0.2239	2	0.01765	0.51966	0.03396
	Band 17	706.5	713.5	23.5	0.2239	2	0.01765	0.471	0.03747
	Band 25	1850.7	1914.3	23.5	0.2239	3	0.02222	1	0.02222
	Band 26	814.7	848.3	24	0.2512	2	0.0198	0.54313	0.03646
	Band 30	2307.5	2312.5	23	0.1995	3	0.0198	1	0.01980
	Band 38	2572.5	2617.5	23.5	0.2239	3	0.02222	1	0.02222
	Band 41	2498.5	2687.5	23.5	0.2239	3	0.02222	1	0.02222
Band 66	1710.7	1779.3	23.5	0.2239	3	0.02222	1	0.02222	

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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