

RF Exposure Evaluation Report

APPLICANT : Casa Systems, Inc.
EQUIPMENT : 5G Enterprise Small Cell
BRAND NAME : Casa Systems
MODEL NAME : 5G2105-48
FCC ID : 2AO385G2105-48
STANDARD : 47 CFR Part 2.1091
FCC KDB 447498 D01 v06

The product evaluation date was started from Feb. 02, 2024 and completed on Feb. 02, 2024. We, Sporton International Inc. (Kunshan), would like to declare that the device has been evaluated in accordance with with 47 CFR Part 2.1091 and FCC KDB 447498 D01 v06, and pass the limit. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.



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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA410208	Rev. 01	Initial issue of report.	Feb. 22, 2024



1. Administration Data

1.1. Testing Laboratory

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02

Table with 4 columns: Test Firm, Test Site Location, Test Site No., and FCC registration numbers.

Table with 2 columns: Applicant Company Name and Address.

Table with 2 columns: Manufacturer Company Name and Address.

2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	5G Enterprise Small Cell
Brand Name	Casa Systems
Model Name	5G2105-48
FCC ID	2AO385G2105-48
Wireless Technology and Frequency Range	LTE Band 4 : 2110 MHz ~ 2155 MHz LTE Band 66 : 2110 MHz ~ 2180 MHz 5G NR n77: 3700 MHz ~3980MHz 5G NR n78: 3450 MHz ~ 3550 MHz
Mode	LTE: QPSK / 16QAM / 64QAM / 256QAM 5G NR: CP-OFDM (QPSK / 16QAM / 64QAM / 256QAM)
Antenna Gain	Internal Antenna: Ant1: LTE Band 4 : 4.06 dBi LTE Band 66 : 4.06 dBi Ant2: LTE Band 4 : 4.71 dBi LTE Band 66 : 4.71 dBi Ant3: 5G NR n77/n78: 6.18 dBi Ant4: 5G NR n77/n78: 6.22 dBi External Antenna: Ant1/2: LTE Band 4 : 8.8 dBi LTE Band 66 : 8.8 dBi Ant3/4: 5G NR n77/n78: 8.0 dBi
Antenna Type	WWAN External Antenna : Directional Antenna WWAN Internal Antenna : PIFA Antenna
HW Version	V03
SW Version	FR4.7
EUT Stage	Production Unit

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. WWAN support SISO/MIMO mode, the Internal Antenna and External Antenna support manual switch, the Internal & External antenna can't work at the same time.
3. 5GNR n77/n78 supports HPUE (power class 2) under SISO mode and HPUE (power class 1.5) under UL MIMO mode for 5G NR n77, so HPUE (power class 1.5) has been performed MPE calculation.
4. The EN-DC mode combination could be referred to the product spec.

Comments and Explanations:

1. The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.
2. The maximum RF output tune up power, antenna gain also the safe distance used for evaluate RF exposure were declared by manufacturer.



3. Maximum RF average output tune up power among production units

<LTE>

<Internal Antenna>

Mode		Maximum Average power(dBm)		
		Ant1	Ant2	Ant1+2
LTE	Band 4	22.00	22.00	25.00
	Band 66	22.00	22.00	25.00

<External Antenna>

Mode		Maximum Average power(dBm)		
		Ant1	Ant2	Ant1+2
LTE	Band 4	22.00	22.00	25.00
	Band 66	22.00	22.00	25.00

<5G NR>

<Internal Antenna>

Mode		Maximum Average power(dBm)		
		Ant3	Ant4	Ant3+4
5G NR	n77 PC3	25.00	25.00	28.00
	n77 PC2	28.00	28.00	31.00
	n78 PC3	24.00	24.00	27.00
	n78 PC2	26.00	26.00	29.00

<External Antenna>

Mode		Maximum Average power(dBm)		
		Ant3	Ant4	Ant3+4
5G NR	n77 PC3	25.00	25.00	28.00
	n77 PC2	28.00	28.00	31.00
	n78 PC3	24.00	24.00	27.00
	n78 PC2	26.00	26.00	29.00

Note: WWAN support SISO/MIMO mode, we only chose MIMO tune up power to perform MPE calculation conservatively for MIMO power is higher.



4. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

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

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna



5. Radio Frequency Radiation Exposure Evaluation

5.1. Standalone Power Density Calculation

Internal Antenna:

Band	Frequency (MHz)	Duty cycle	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Average EIRP (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)	Power Density / Limit
LTE Band 4	2110.0	100.00%	4.71	25.00	29.710	935.406	0.064	1.000	0.064
LTE Band 66	2110.0	100.00%	4.71	25.00	29.710	935.406	0.064	1.000	0.064
5G NR n77	3700.0	80.00%	6.22	31.00	36.220	4187.936	0.288	1.000	0.288
5G NR n78	3450.0	80.00%	6.22	29.00	34.220	2642.409	0.182	1.000	0.182

External Antenna:

Band	Frequency (MHz)	Duty cycle	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Average EIRP (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)	Power Density / Limit
LTE Band 4	2110.0	100.00%	8.80	25.00	33.800	2398.833	0.165	1.000	0.165
LTE Band 66	2110.0	100.00%	8.80	25.00	33.800	2398.833	0.165	1.000	0.165
5G NR n77	3700.0	80.00%	8.00	31.00	38.000	6309.573	0.435	1.000	0.435
5G NR n78	3450.0	80.00%	8.00	29.00	36.000	3981.072	0.274	1.000	0.274

Note:

1. Chose the maximum power and the maximum antenna gain to do MPE analysis.
2. The MIMO mode is completely uncorrelated, so selected the higher SISO gain among all antennas as MIMO gain to perform MPE calculation.
3. For 5G NR Evaluation, using perform MPE analysis with default 80% (Declared by Manufacturer) transmission.

5.2. Collocated Power Density Calculation

LTE Power Density / Limit	5G NR Power Density / Limit	Σ(Power Density / Limit) of LTE + 5G NR
0.165	0.435	0.600

Note:

1. For collocation analysis of Internal or External Antenna, LTE Band 66 is chosen for summation due to the highest (power density/limit) among all LTE Band modes.
2. For collocation analysis of Internal or External Antenna, 5G NR n77 is chosen for summation due to the highest (power density/limit) among all 5G NR Band modes.
3. WWAN support SISO/MIMO mode, the Internal Antenna and External Antenna support manual switch, the Internal & External antenna can't work at the same time.
4. The device support LTE + 5G NR simultaneous transmission mode, they also support LTE MIMO + 5G NR MIMO simultaneous transmission mode.
5. Σ(Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for LTE+ 5G NR.

Conclusion:

According to 47 CFR §2.1091, the RF exposure analysis concludes that the RF Exposure is FCC compliant.

-----THE END-----