

RF Exposure Evaluation Report

FCC ID : 2AFZZ123G
EQUIPMENT : Mobile Phone
Brand Name : XIAOMI
Model Name : 2201123G
Applicant : Xiaomi Communications Co., Ltd.
#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
Manufacturer : Xiaomi Communications Co., Ltd.
#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
STANDARD : FCC CFR 47 part 1, 1.1307(b) and 1.1310
47 CFR Part 2.1091, KDB 680106 D01v03,
FCC KDB 447498 D01 v06

We, Sporton International (Kunshan) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures given in KDB 680106 D01v03 and FCC KDB 447498 D01 v06, and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Kunshan) Inc., the test report shall not be reproduced except in full.

Tony Zhang

Reviewed by: Tony Zhang / Supervisor

Kat Yin

Approved by: Kat Yin / Manager



Sporton International (Kunshan) Inc.

**No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China**



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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA1O2709A	Rev. 01	Initial issue of report	Dec. 15, 2021
FA1O2709A	Rev. 02	Added RF exposure of simultaneous transmission	Jan. 17, 2022



1. Description of Equipment Under Test (EUT)

Product Feature & Specification	
Equipment Name	Mobile Phone
Brand Name	XIAOMI
Model Name	2201123G
FCC ID	2AFZZ123G
Wireless Technology and Frequency Range	GSM850: 824 MHz ~ 849 MHz GSM1900: 1850 MHz ~ 1910 MHz WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 17: 704 MHz ~ 716 MHz LTE Band 25: 1850 MHz ~ 1915 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 42: 3450 MHz ~ 3550 MHz LTE Band 48: 3550 MHz ~ 3700 MHz LTE Band 66: 1710 MHz ~ 1780 MHz 5G NR n5: 824 MHz ~ 849 MHz 5G NR n7: 2500 MHz ~ 2570 MHz 5G NR n38 : 2570 MHz ~ 2620 MHz 5G NR n41: 2496 MHz ~ 2690 MHz 5G NR n66 : 1710 MHz ~ 1780 MHz 5G NR n77: 3450 MHz ~ 3550 MHz, 3700 MHz ~ 3980 MHz 5G NR n78: 3450 MHz ~ 3550 MHz, 3700 MHz ~ 3800 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz WLAN 6E U-NII-5: 5925 MHz ~ 6425 MHz WLAN 6E U-NII-6: 6425 MHz ~ 6525 MHz WLAN 6E U-NII-7: 6525 MHz ~ 6875 MHz WLAN 6E U-NII-8: 6875 MHz ~ 7125 MHz Bluetooth: 2402 MHz ~ 2480 MHz WPC: 110 kHz ~ 148 kHz NFC: 13.56 MHz
Mode	GSM/GPRS/EGPRS RMC/AMR 12.2Kbps HSDPA HSUPA DC-HSDPA HSPA+(16QAM uplink is not supported) LTE: QPSK, 16QAM, 64QAM, 256QAM 5G NR : CP-OFDM / DFT-s-OFDM, PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 2.4GHz 802.11ax HE20/HE40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80/VHT160 WLAN 5GHz 802.11ax HE20/HE40/HE80/HE160 WLAN 6GHz 802.11ax HE20/HE40/HE80/HE160 Bluetooth BR/EDR/LE WPC: ASK NFC:ASK



HW Version	P2.1
SW Version	MIUI13
GSM / (E)GPRS Transfer mode	Class B – EUT cannot support Packet Switched and Circuit Switched Network simultaneously but can automatically switch between Packet and Circuit Switched Network.
EUT Stage	Identical Prototype
Date of Test	Dec. 08, 2021

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
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. The maximum RF output tune up power, antenna gain also the safe distance used for evaluate RF exposure were declared by manufacturer.

2. Administration Data

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

Testing Laboratory			
Test Firm	Sporton International (Kunshan) Inc.		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	ES02-KS	CN1257	314309



3. Antenna Gain

<GSM/WCDMA>

Band	Antenna Gain (dBi)			
	Ant 0	Ant 1	Ant 3	Ant 4
GSM850	-4.1	-4.8	-	-
GSM1900	-	-	-2.7	-1.5
WCDMA band 4	-	-	-2.1	-1.8
WCDMA band 5	-4.1	-4.8	-	-
WCDMA band 2	-	-	-2.7	-1.5

<LTE>

Band	Antenna Gain (dBi)					
	Ant 0	Ant 1	Ant 3	Ant 4	Ant 5	Ant 7
LTE Band 2	-	-	-2.7	-1.5	-	-
LTE Band 4	-10.8	-	-2.1	-1.8	-4.0	-
LTE Band 5	-4.1	-4.8	-	-	-	-
LTE Band 7	-8.8	-	-2.0	-1.6	-7.2	-7.5
LTE Band 12	-6.3	-6.0	-	-	-	-
LTE Band 13	-6.5	-6.2	-	-	-	-
LTE Band 17	-6.3	-6.0	-	-	-	-
LTE Band 25	-	-	-2.7	-1.5	-	-
LTE Band 26	-4.1	-4.8	-	-	-	-
LTE Band 66	-10.7	-	-2.1	-1.8	-4.0	-
LTE Band 38	-9.3	-	-2.2	-1.6	-6.5	-
LTE Band 41	-9.0	-	-2.0	-1.6	-6.5	-

Band	Antenna Gain (dBi)			
	Ant 10	Ant 11	Ant 12	Ant 13
LTE Band 42	-5.8	-1.1	-3.9	-3.0
LTE Band 48	-5.8	-1.2	-4.0	-2.9

<5G NR>

Band	Antenna Gain (dBi)				
	Ant 0	Ant 1	Ant 3	Ant 4	Ant 5
FR1 n5	-4.1	-4.8	-	-	-
FR1 n7	-8.8	-	-2.0	-1.6	-7.2
FR1 n66	-10.7	-	-3.8	-1.6	-4.0
FR1 n38	-9.3	-	-2.2	-1.6	-6.8
FR1 n41	-9.0	-	-2.0	-1.6	-7.2

Band	Antenna Gain (dBi)			
	Ant 10	Ant 11	Ant 12	Ant 13
FR1 n77	-1.9	-5.4	-2.5	-2.7
FR1 n78	-1.9	-5.4	-2.5	-2.7



<WLAN>

Band	Antenna Gain (dBi)		
	Ant 16	Ant 17	Ant 18
Bluetooth	-2.5	-	-3.0
2.4GHz WLAN	-2.5	-	-3.0
5.2GHz WLAN	-	-2.8	-6.1
5.3GHz WLAN	-	-2.5	-5.0
5.5GHz WLAN	-	-1.5	-5.0
5.8GHz WLAN	-	-0.4	-4.5
UNII-5	-	-0.4	-5.0
UNII-6	-	-1.6	-5.7
UNII-7	-	-2.0	-6.0
UNII-8	-	-2.9	-6.8

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

Band/Mode	Maximum Average power(dBm)	
	Ant 0	Ant 1
GSM850 GSM 1 Tx slot	33.5	34.0
GSM850 GPRS 1 Tx slot	33.5	34.0
GSM850 GPRS 2 Tx slots	30.5	31.0
GSM850 GPRS 3 Tx slots	28.5	29.0
GSM850 GPRS 4 Tx slots	27.5	28.0
GSM850 EDGE 1 Tx slot	27.5	28.0
GSM850 EDGE 2 Tx slots	24.5	25.0
GSM850 EDGE 3 Tx slots	23.0	23.5
GSM850 EDGE 4 Tx slots	21.5	22.0
WCDMA V	25.0	25.0
LTE Band 66(4)	24.5	-
LTE Band 26(5)	25.5	25.7
LTE Band 7	24.5	-
LTE Band 12(17)	25.5	25.7
LTE Band 13	25.5	25.7
LTE Band 41(38)	24.5	-
FR1 n5	25.5	25.7
FR1 n7	24.5	-
FR1 n66	24.5	-
FR1 n38	24.5	-
FR1 n41	24.5	-

Band/Mode	Maximum Average power(dBm)			
	Ant 3	Ant 4	Ant 5	Ant 7
GSM1900 GSM 1 Tx slot	30.5	30.5	-	-
GSM1900 GPRS 1 Tx slot	30.5	30.5	-	-
GSM1900 GPRS 2 Tx slots	27.5	27.5	-	-
GSM1900 GPRS 3 Tx slots	25.5	25.5	-	-
GSM1900 GPRS 4 Tx slots	24.5	24.5	-	-
GSM1900 EDGE 1 Tx slot	26.5	26.5	-	-
GSM1900 EDGE 2 Tx slots	24.0	23.0	-	-
GSM1900 EDGE 3 Tx slots	21.5	21.5	-	-
GSM1900 EDGE 4 Tx slots	20.5	20.5	-	-



WCDMA II	25.0	25.0	-	-
WCDMA IV	25.0	25.0	-	-
LTE Band 2	25.5	25.5	-	-
LTE Band 25	25.5	25.5	-	-
LTE Band 66(4)	25.5	25.5	24.5	-
LTE Band 7	25.5	25.5	24.5	24.5
LTE Band 41(38)	25.5	25.5	25.5	-
FR1 n7	24.0	25.5	23.0	-
FR1 n66	24.0	25.5	23.0	-
FR1 n38	24.0	25.5	25.7	-
FR1 n41	24.0	25.5	25.7	-

Band/Mode	Maximum Average power(dBm)			
	Ant 10	Ant 11	Ant 12	Ant 13
LTE Band 42	25.7	22.5	22.0	25.7
LTE Band 48	23.5	20.0	19.5	23.5
FR1 n77	25.7	25.7	25.7	25.7
FR1 n78 PC3	25.7	25.7	24.0	24.0
FR1 n78 PC2	27.0	27.0	27.0	27.0

Band/Mode	Maximum Average power(dBm)
WLAN2.4GHz-Ant16+18	23.5
WLAN5.2GHz-Ant17+18	23.0
WLAN5.3GHz-Ant17+18	23.0
WLAN5.5GHz-Ant17+18	23.0
WLAN5.8GHz-Ant17+18	23.0
WLAN 6E-Ant17+18	19.5
BT-Ant16	16.5
BT-Ant18	17.0

Note:

1. WLAN2.4GHz/WLAN5GHz all support SISO/MIMO mode, we only chose MIMO tune up power to perform MPE calculation conservatively for MIMO power is higher.



5. RF Exposure Limit Introduction

§ 1.1310 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 § 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of § 2.1093 of this chapter.

Table with 5 columns: Frequency range (MHz), Electric field strength (V/m), Magnetic field strength (A/m), Power density (mW/cm²), Averaging time (minutes). It is divided into (A) Limits for Occupational/Controlled Exposure and (B) Limits for General Population/Uncontrolled Exposure.

f = frequency in MHz

* = Plane-wave equivalent power density

(1) Occupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when a person is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure. The phrase fully aware in the context of applying these exposure limits means that an exposed person has received written and/or verbal information fully explaining the potential for RF exposure resulting from his or her employment. With the exception of transient persons, this phrase also means that an exposed person has received appropriate training regarding work practices relating to controlling or mitigating his or her exposure. Such training is not required for transient persons, but they must receive written and/or verbal information and notification (for example, using signs) concerning their exposure potential and appropriate means available to mitigate their exposure. The phrase exercise control means that an exposed person is allowed to and knows how to reduce or avoid exposure by administrative or engineering controls and work practices, such as use of personal protective equipment or time averaging of exposure.

(2) General population/uncontrolled exposure limits apply in situations in which the general public may be exposed, or in which persons who are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

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 = PG / (4πR²)

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna



6. Test Mode

This device has been tested in the following charging conditions as below:

Table with 3 columns: Test Mode, Test Setup Configuration, Charging Current Condition. Rows include TM1, TM2, and TM3.

7. Measurement Equipment

Table with 7 columns: Instrument, Manufacturer, Model No., Serial No., Freq Rang, Last Cal., Due Date. Row includes Electric and Magnetic field Probe-Analyzer.

8. RF Exposure Evaluation

8.1. Field strengths Evaluation

- 1. The device support Wireless Power Consortium (WPC or commonly referred to as Qi) standard EPP (Extended Power Profile) as a receiver...
2. According to 202010 TCBC workshop, for portable devices that do not physically attach to phone, desktop WPT testing guidance from FCC KDB 680106 D01v03 is applied.
3. The equipment under test was placed on a wooden desk inside of shield room. The isotropic field probe was used to measure the field strength for 6 EUT surfaces.
4. Per KDB 680106 D01v03 and 202010 TCBC workshop, RF exposure should be evaluation at 15 cm surrounding the device and 20 cm away from the surface from all coils.

Table with 9 columns: Position (Distance), A (15cm), B (15cm), C (15cm), D (15cm), E (20cm), F (20cm), Limit (A/m), Field strength / Limit. Rows include TM1, TM2, and TM3.



8.2. Radio Frequency Radiation Exposure Evaluation

Standalone Power Density Calculation:

Table with 10 columns: Band, Frequency (MHz), Antenna Gain (dBi), Maximum Power (dBm), Maximum EIRP (dBm), Maximum EIRP (W), Average EIRP (mW), Power Density at 20cm (mW/cm^2), Limit (mW/cm^2), Power Density / Limit. Rows include GSM, GPRS, EGPRS, WCDMA, LTE, and 5G NR bands.

Note:

- 1. For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.
2. Chose the maximum RF output tune up power of all antennas among same frequency WWAN bands and the maximum antenna gain to perform MPE calculation conservatively.
3. Chose the worst power density among WLAN2.4/5GHz to do co-located.



4. LTE band 2/4/5/17/38 and 5GNR n38 covered by LTE band 25/66/26/12/41 and 5GNR n41 with the same power level, so only chose LTE band 25/66/26/12/41 and 5GNR n41 to perform standalone power density calculation.

8.3. Conclusion Calculation

WPT Field strength / Limit	WWAN Power Density / Limit	WLAN 5GHz Power Density / Limit	BT Power Density / Limit	$\Sigma(\text{Field strength / Limit}) + \Sigma(\text{Power Density / Limit})$ of WPT+WWAN + WLAN 5GHz +BT
0.033	0.064	0.036	0.006	0.139
WPT Field strength / Limit	WWAN Power Density / Limit	WLAN 6GHz Power Density / Limit	BT Power Density / Limit	$\Sigma(\text{Field strength / Limit}) + \Sigma(\text{Power Density / Limit})$ of WPT+WWAN + WLAN 6GHz + BT
0.033	0.064	0.016	0.006	0.119
WPT Field strength / Limit	WWAN Power Density / Limit	WLAN 2.4GHz Power Density / Limit	WLAN 5GHz Power Density / Limit	$\Sigma(\text{Field strength / Limit}) + \Sigma(\text{Power Density / Limit})$ of WPT+WWAN + WLAN 2.4GHz + WLAN 5GHz
0.033	0.064	0.025	0.036	0.158
WPT Field strength / Limit	WWAN Power Density / Limit	WLAN 2.4GHz Power Density / Limit	WLAN 6GHz Power Density / Limit	$\Sigma(\text{Field strength / Limit}) + \Sigma(\text{Power Density / Limit})$ of WPT+WWAN + WLAN 2.4GHz + WLAN 6GHz
0.033	0.064	0.025	0.016	0.138

WPT Field strength / Limit	LTE Power Density / Limit	5GNR Power Density / Limit	WLAN 5GHz Power Density / Limit	BT Power Density / Limit	$\Sigma(\text{Field strength / Limit}) + \Sigma(\text{Power Density / Limit})$ of WPT+ENDC + WLAN 5GHz +BT
0.033	0.057	0.064	0.036	0.006	0.163
WPT Field strength / Limit	LTE Power Density / Limit	5GNR Power Density / Limit	WLAN 6GHz Power Density / Limit	BT Power Density / Limit	$\Sigma(\text{Field strength / Limit}) + \Sigma(\text{Power Density / Limit})$ of WPT+ ENDC + WLAN 6GHz + BT
0.033	0.057	0.064	0.016	0.006	0.143
WPT Field strength / Limit	LTE Power Density / Limit	5GNR Power Density / Limit	WLAN 2.4GHz Power Density / Limit	WLAN 5GHz Power Density / Limit	$\Sigma(\text{Field strength / Limit}) + \Sigma(\text{Power Density / Limit})$ of WPT+ ENDC + WLAN 2.4GHz + WLAN 5GHz
0.033	0.057	0.064	0.025	0.036	0.182
WPT Field strength / Limit	LTE Power Density / Limit	5GNR Power Density / Limit	WLAN 2.4GHz Power Density / Limit	WLAN 6GHz Power Density / Limit	$\Sigma(\text{Field strength / Limit}) + \Sigma(\text{Power Density / Limit})$ of WPT+ ENDC + WLAN 2.4GHz + WLAN 6GHz
0.033	0.057	0.064	0.025	0.016	0.162

Note:

- For colocation analysis, 5GNR n78 is chosen for summation due to the highest (power density/limit) among all WWAN wireless SA modes.
- For colocation analysis, LTE Band 42 is chosen for summation due to the highest (power density/limit) among all LTE WWAN wireless modes.
- For colocation analysis, 5GNR n78 is chosen for summation due to the highest (power density/limit) among all 5GNR modes.



4. Chose the worst power density among WLAN2.4/5GHz to do co-located.
5. $\Sigma(\text{Field strength} / \text{Limit})$: This is a summation of [(Field strength for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], $\Sigma(\text{Power Density} / \text{Limit})$: This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WPT+WWAN + WLAN 5GHz +BT, WPT+WWAN + WLAN 6GHz +BT, WPT+WWAN + WLAN 2.4GHz + WLAN 5GHz, WPT+WWAN + WLAN 2.4GHz + WLAN 6GHz.
6. Considering the WWAN and 5G NR module collocation with the WLAN/Bluetooth transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit and Field strength / Limit) is smaller than 1, and MPE of 4 collocated transmitters is compliant.

Conclusion:

According to 47 CFR, The field strength and the RF exposure analysis concludes that the RF Exposure is FCC compliant.